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COMMUNITY PATTERNS REVEALED BY TRAWLING IN THE INTER-REEF REGIONS OF THE GREAT BARRIER REEF

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ABSTRACT

Several series of exploratory trawls on and adjacent to the Great Barrier Reef produced approximately 15,000 specimens of fish and macro-invertebrates representing some 700 species. Classification and ordination analyses of the catch from the principal trawl series made over easily trawlable grounds showed no clearly definable community assemblages — rather a gross continuum with a tendency to depth descrimination — a discrimination revealed most sharply by the fishes. More rigorous sampling in a smaller area, but including 'foul ground', reinforced this depth related patterning (again most evident from the fishes) which, in turn, correlated well with sediment type and distance from shore. This study supports others which suggest the trawlable regions of the tropical continental shelf may be biologically separable into few continua. Complete faunal/station lists are given.

INTRODUCTION

Despite extensive commercial trawling activity along the Queensland coast we have a relatively poor knowledge of the animal assemblages that inhabit trawlable areas. From September 1979 to May 1982 several series of trawls were conducted by both Commonwealth and State Fisheries to explore for new trawl areas, especially in the more difficult inter-reef regions. Although not designed to systematically sample the Queensland shelf, the trawls did produce a great quantity of demersal and macrobenthic animals which were made available to the Queensland Museum. This paper attempts to interpret and summarize these data.

Although Frankel (1978) listed some 4500 citations for the Great Barrier Reef Region, most of these relate to the coral environs. Literature dealing with the structure of the trawl fish community and its distribution in this geographical area is limited to Kailola and Wilson (1978) and Watson (1984) for the Gulf of Papua, Liu (1976), Lui, Lai and Yeh (1978) and Lee (1979) for the northern Gulf of Carpentaria, and Rainer and Munro (1982) for the southern Gulf of Carpentaria.

Our trawl data are for the Great Barrier Reef Region especially between Cape York Peninsula and Townsville and our intention was to determine the nature and limits of the assemblages or of community types that occupy the trawlable soft-bottom environment between coral reefs. Differences in collection methods and data handling techniques has meant that final analyses were limited to subsets of the original material.

Available data suggest that commercial trawling beyond the established trawl zones in inter-reef areas of the Great Barrier Reef Region currently is quite limited, but increasing as a result of economic pressures on the large, coastal prawn-trawl fishery (Hundloe, 1985). It can be assumed, therefore, that the data sets for such areas are descriptive of the original unexploited demersal communities and thus have considerable value as base-line information from which longer term management decisions can be formulated.

Rainer and Munro (1982) confined their study to fishes and cephalopods, both relatively easy to identify and highly mobile within the environment. This study included most macrofauna collected by the trawls, viz. fish, echinoderms, crustacea, molluscs, cnidarians and sponges. While trawling undoubtedly may not be the favoured collection technique to sample all these groups most effectively, in practical terms trawling does yield large quantities of all the groups mentioned. We included the six major groups (but excluded 'minor' groups such as ascidians, bryozoans and various worm groups) because we believed that they were likely to increase the resolution of community types and because they seemed most likely to show the effects of increased trawling effort in the future.

STUDY AREA

The Great Barrier Reef Region is a vast area of diverse and complex geological and hydrological features (Maxwell, 1968) dominated by coral reefs and lying along the Queensland coast north from approximately 25°S. To the north the Region tends to disperse through the Torres Strait (9°S–11°S) and merge with the huge coastal estuaries of the Papuan Gulf. To the west of the Torres Strait the Region merges with the Gulf of Carpentaria which is an expansive shallow gulf with relatively little hydrographic variation (Munro, 1972) and an almost complete lack of coral reefs.

Seven series of trawls (0 through VI) were undertaken in the Great Barrier Reef Region (Fig. 1). While the vast majority of these trawls were completed on the soft-bottom inter-reef areas of the continental shelf, most of the Series III trawls were on the continental slope. A summary of station data for each trawl series including dates, locations, depths and bottom characteristics is presented in Appendix I.

METHODS

From February 1979 to May 1982 a total of 229 sites in seven series of trawls were sampled: more than 15,000 specimens representing approximately 700 species were obtained. Because the rationale of each trawl series varied, there has been corresponding variation in the methods of obtaining and handling the biological material that forms the basis of these analyses.

Biological Data — Trawled material was generally frozen in bulk aboard the survey vessel. The frozen samples were then returned to the laboratory and thawed, where practicable in preservative, and sorted to phylum. These preserved specimens were transported to the Queensland Museum for identification. Species were identified from available literature. In many cases (especially for the lower groups) identification to the species level could not be determined with confidence because the fauna is in need of considerable taxonomic research. Where names could not be applied, and more than one species was believed present, they were listed as spp. Every attempt has been made to make names and classifications follow the most current available literature. Appendix II gives a checklist of the fauna related to stations.

Physical Data — Only physical data relating to depth and some subjective classifications of bottom type derived from the trawl logs are presented (see Appendix I). Other data were inconsistently gathered or reported. Sediment carbonate content was derived from Maxwell (1968).

Data Analysis — No attempt was made to analyse all the data because of the disparate nature in which they were collected. Two series (I and V), however, were analysed. In the larger (series I) data set only binary (presence, absence) data were collected. The series V cruise was made specifically to investigate potential patterning and numerical data were obtained.

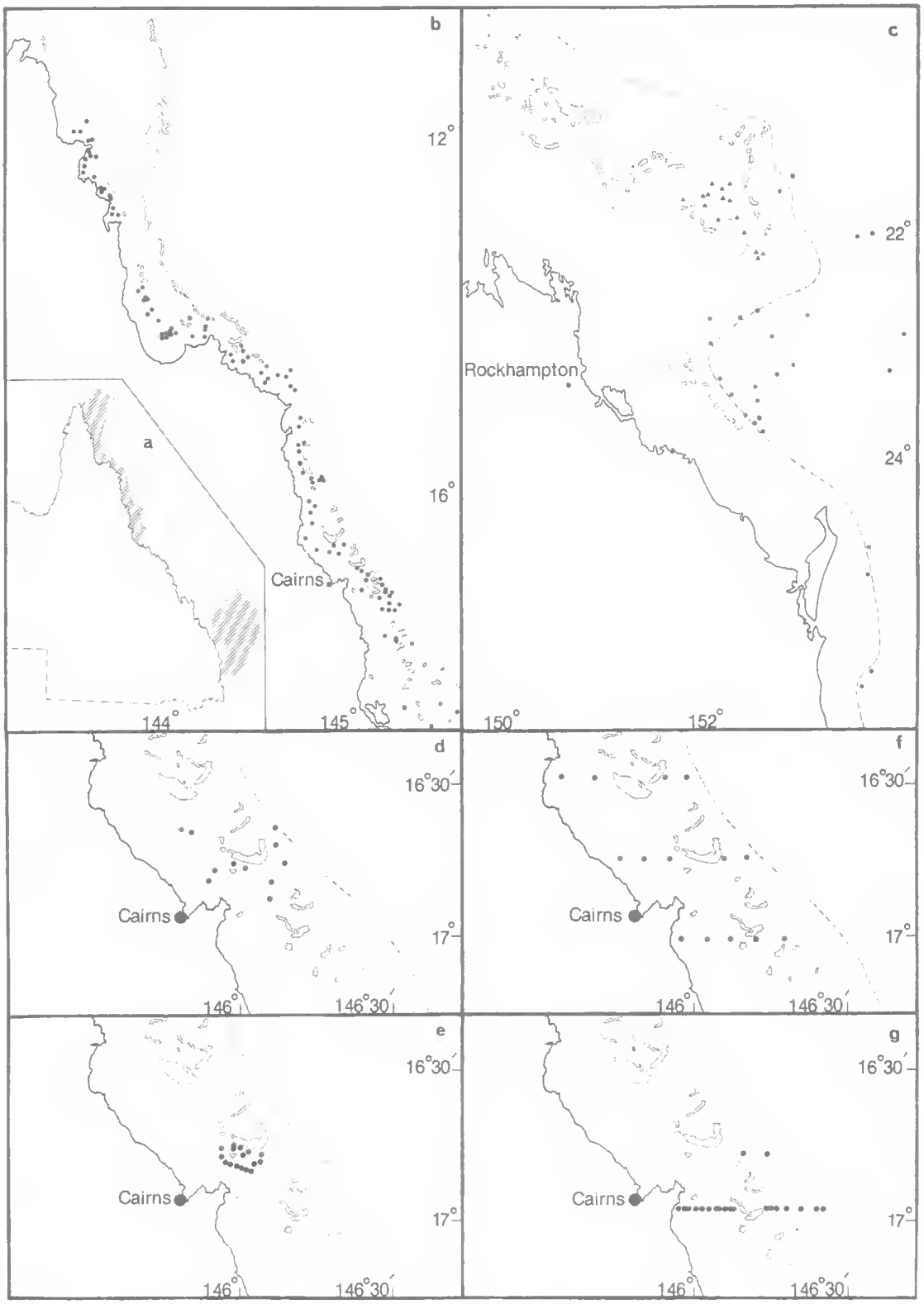
Stephenson (1973) summarized the earlier attempts to understand and quantify the nature of marine benthic communities or assemblages. Community analysis in recent times has commonly used either ordination or classification techniques. These strategies are not considered mutually exclusive (McIntosh, 1967) and can be gainfully combined in a single analysis (Lambert and Dale, 1964).

Ordination techniques attempt to reduce data dimensionally while retaining maximum information on inter-entity relationships. At least in marine benthic work, however, classification has been more commonly employed in community analysis (e.g. Rainer and Munro, 1982). It places entities in classes based upon shared attributes.

In the present study both ordination and classification were used in interpreting results by highlighting complementary facets of the data patterns. In particular the ordinations allowed interpretation of the classificatory dendrograms by providing a means of observing group overlap.

The analyses made use of the TAXON programme package (CSIRO computer network). We used the Canberra metric dissimilarity measure to generate the classifications and as input into the principal coordinate analysis used for ordinations. For classification the 'flexible' sorting strategy of Lance and Williams (1967) was used. This follows the successful precedents of Stephenson and Williams (1971), Williams and Stephenson (1973) and Stephenson, Williams and Cook (1974). The 'cluster intensity coefficient', Beta, was set at −0.25 which means it is a slightly space dilating strategy less likely to show 'chaining' tendencies. In addition we employed the Cramer measure to provide an insight into which attributes (i.e.

FIG 1. Locality of trawls.
a. Distribution of trawl series along Queensland coast.
b. Series I stations
c. Series II (▲) and III (●) stations
d. Series 0 stations
e. Series IV stations
f. Series V stations
g. Series VI stations


b
12°
16°
a
Cairns
144°
145°
c
22°
Rockhampton
24°
150°
152°
d
16°30′
Cairns
17°
146°
146°30′
f
16°30′
Cairns
17°
146°
146°30′
e
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Cairns
17°
146°
146°30′
g
16°30′
Cairns
17°
146°
146°30′

species) contributed most significantly to the determination of classificatory groups (Lance and Williams, 1977).

In series I, apart from a small group of stations in Princess Charlotte Bay where large nets were deployed, material was collected with a commercial 'try' net, i.e. one with only a 2m gape. Quantitative measures were not obtained, thus analyses were confined to binary attributes. The large number of species (>700), many of which were rare ocurrences, suggested truncation of the data set; thus single species and/or site occurrences were eliminated. We restricted the data set further by analysing attributes at both the family and genus level separately rather than at the species level (which was used only for the fish). This served several purposes; it eliminated some of the taxonomic uncertainty, it increased the coarseness of the analysis to one more in keeping with the area surveyed and measures used in collecting while retaining biological reality and, not insignificantly, it greatly simplified the data matrix.

In series V the small 'try' nets were again used, but numerical counts of the species were made. These data were analysed by the same methods; because of the relatively small area and greater rigor of the trawling procedure there was no truncation of the data. Before analysis, this data set was transformed (square root) in an attempt to normalise the data.

The other trawl series were not analysed because we felt the disparity in collection methods precluded useful conclusions. Series 0 trawls which gave some very preliminary results from simple statistical tests were undertaken as a ancillary to trials of underwater video gear (Goeden and Cannon, 1980). Series II were designed specifically to investigate scallop grounds, III were conducted with large fish trawls in deep water towards the edge of the continental shelf, IV were specifically to search for Crown-of-Thorns starfish and VI employed both main gear trawls and a small dredge in a exercise to trial a new boat and its gear. The station species lists are included in Appendix II, however, for they may be considered to fulfill a useful role in their own right.

RESULTS

Trawl Series I

Primary Analysis

Initially analyses were directed at the six major groups: Fish, Echinodermata, Crustacea, Mollusca, Cnidaria and Porifera.

Family Level

When analysed at the family level the classifactory programme generated ten clusters, but the level at which these clusters were discriminated suggests only three biologically valid (meaningful) groups (Figure 2a):

I A, B, C, D, E
II F, G, H
III I, J

Of these three groups none showed any strong correlations with the abiotic factors geographic position or bottom type, but depth did show a weak influence. From examination of the Cramer discrimination values, the invertebrates showed strongly in group I (Echinoderms : Comasteridae, Laganidae) and fish in groups II (Leiognathidae) and III (Bothidae). The ordination analysis (Figure 2b) showed sites grouped by the classification were not discretly differentiated, but rather the site groups overlapped strongly. The family most strongly influencing the ordination was the Penaeidae (prawns) found predominantly in one of the subgroups of group II. This particular subgroup corresponded to collection sites in Princess Charlotte Bay. The families influencing the ordination positively included the fish families Leiognathidae, Hemipteridae, Scorpaenidae and Apogonidae. In contrast, the echinoderm families. Comasteridae, Temnopleuridae and Goniasteridae were inversely associated with the pattern. Thus these data produce no convincing patterns.

Genus Level

The classificatory programme was run a second time on the six major groups using taxa at the generic level. Once again ten clusters were formed which were best discriminated again into three groups (Fig 2c):

I A, B, C, D
II E, F, G, H, I
III J

In two groups, we found the genera *Minous* (Scorpaenidae: Fish), *Amusium* (Pectinidae: Mollusca), *Leiognathus* (Leiognathidae: Fish), *Nemipterus* (Nemipteridae: Fish) and *Comatula* (Comasteridae: Echinoderm) were the most influential taxa, being relatively well presented in group II, but not, or poorly in group I, i.e., in group I invertebrates dominated and in group II fish dominated. The ordination of site groups determined at the generic level (Fig. 2c), although overlapping in some cases, differed from those found at the family level. The major exception to

this was again the strong isolation of the Princess Charlotte Bay sites (Group III).

Both analyses of the six major groups produced a similar pattern: an invertebrate rich group of sites and one rich in fish, plus the Princess Charlotte Bay sites. The composition of the groups, however, differed in the two analyses.

Secondary Analysis

Both analyses involving all the groups implied that taxa in the groups Mollusca, Cnidaria and Porifera had little effect upon the classification. The data set was therefore restricted to Fish, Echinodermata and Crustacea i.e., removing all sedentary sponges and cnidarians and also the molluscs — predominatly animals living in the sediments. Although such fauna is collected by trawls, they are perhaps more ably sampled by other techniques.

Family Level

The classification at the family level (Fig. 3a) created four groups, one of which containing only 2 stations was considered inconsequential (Group IV/J). The important groups were:

I A,B,C,D,E,F — rich in all three groups of organisms and including a subset from Pincess Charlotte Bay,
II G — with some crustacea, but generally poor in fauna, and
III H,I — rich in fish and echinoderms, but relatively poor in crustacea.

The ordination of these data did not produce any clearly defined axes of variation. This lack of strong pattern was emphasized by the diffuse spread of the classification site groups over the major ordination axes (Fig. 3b).

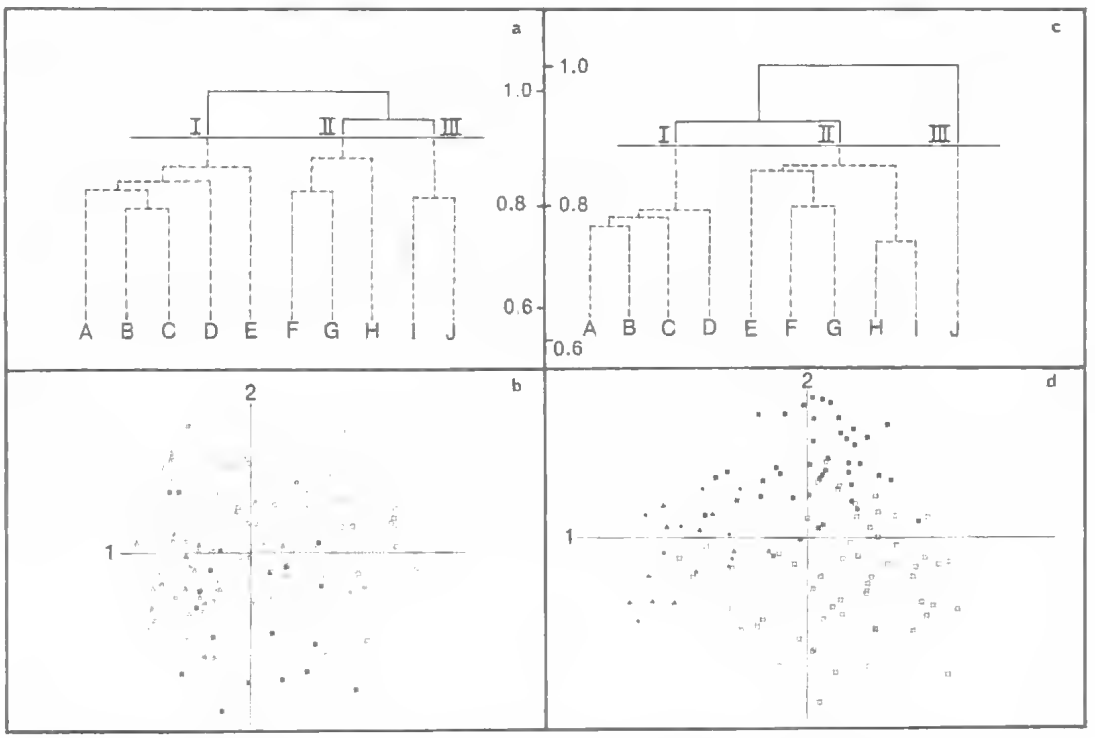

Fig 2. Analysis of sites from series I (Fish, Echinoderms, Crustacea, Molluscs, Porifera and Cnidaria).
a. Classification — Family level
b. Ordination — Family level
I = △, II = ○, III = ■. (Groups from 2a).
c. Classification — Genus level
d. Ordination — Genus level
I = ■, II = □, III = ▲. (Groups from 2c).

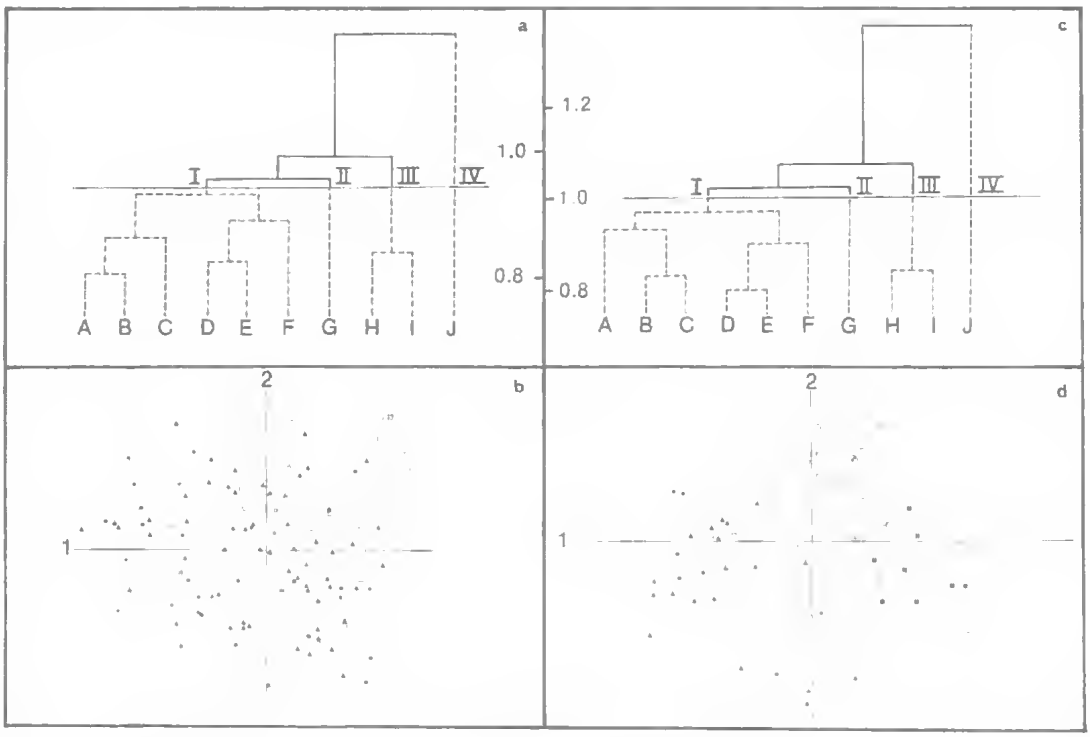

FIG 3. Analysis of sites from series I (Fish, Echinoderms and Crustacea). Group IV points have been omitted as insignificant.
a. Classification — Family level
b. Ordination — Family level
I = ▲, II = △, III = □. (Groups from 3a).
c. Classification — Genus level
d. Ordination — Genus level
I = ○, II = ■, III = ▲. (Groups from 3c).

Genus Level

In Fig. 3c we see some chaining of the site groups occurs at the generic level. Ignoring the clearly aberrant group (IV/J) we again see three groups:

I A,B,C,D,E,F — rich in some genera of crustaceans and echinoderms,

II G — a small group containing *Saurida* and *Comatula* and

III H,I — a large group rich in crustacea and fish (this group includes the Princess Charlotte Bay sites among others).

Once again ordination of these data (Fig. 3d) revealed overlapping groups and, as occurred when all groups were considered, it was not easy to directly relate the analyses to one another. Certainly the Princess Charlotte Bay sites were discriminated, but overall analyses of the series I trawls using higher taxonomic levels failed to reveal discrete assemblages and, at best, presented only a weak depth related pattern.

TERTIARY ANALYSIS

In all the analyses so far presented fish appeared to be the most influential taxa in determining what separations did occur. Thus a further analysis of the fish alone was performed and at the species level.

Species Level

Fig. 4a shows the pattern of the classification with four groups revealed:

I A — A group of shallow water sites largely from Princess Charlotte Bay. The most significant representative fish were *Psettodes erumei*, *Saurida tumbil* and *Pseudorhombus elevatus*.

II B,C,D, and E — Also a cluster of shallow sites lacking the above species but characterised by *Engyprosopon grandisquamma*.

III F and G — A number of slightly deeper sites with the fish *Euristhmus elongatus* and *Arnoglossus* spp.

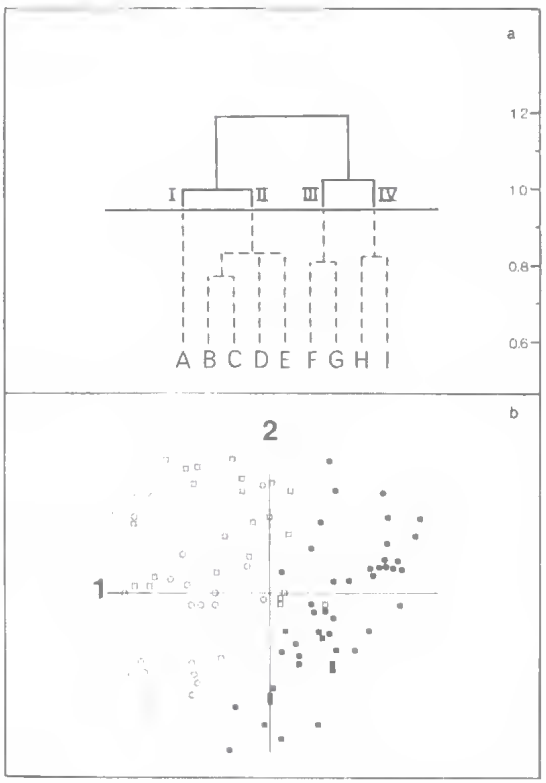

FIG 4. Analysis of sites from series I (Fish only)
a. Classification — Species level
b. Ordination — Species level
I = ●, II = ■, III = ○, IV = □.
(Groups from 4a)

IV H and I — Also deeper sites, though lacking the *Arnoglossus* spp. they did have *Pristotis (Daya) jerdoni*.

An examination of the Cramer values revealed that sites in groups I and II were discriminated by *Pomadasys* spp. while those of groups III and IV had several influential fish species, viz. *Pseudorhombus elevatus*, *P. diplospilus*, *Grammatobothus polyophthalmus* and *Paramonocanthus* sp.

The ordination analysis (Fig. 4b) reinforces the separation of four groups and emphasises the similarity of I with II and III with IV. Indeed, compared with the earlier analyses, the overlap of sites between site groups is not at all marked. The most influential species in this analysis were as follows:

Group I *Pomadasys argyreus*, *Nemipterus* sp., *Upeneus sundiacus*.
Group II *Apogon fasciata* and *Rogadius* sp.
Group III *Pseudorhombus* spp., *Saurida undosquamus* and *Grammatobothus polyophthalmus*.
Group IV again *Apogon fasciata*.

The mean depth of the groups I and II was 25.7m while that of III and IV was 35.5m. This analysis showed more clearly that a separation related to depth (or distance from shore) was apparent. These presence/absence data reveal that distinctions were based often on the absence of certain species in an otherwise similar mix as well as the presence of significant species e.g. *Apogon fasciata* in more than one group.

All the analyses tended to reinforce the importance of certain taxa, most notably flatfishes, grinners and nemipterids, but at each level groups were not always consistent (with the exception of the suite of sites from Princess Charlotte Bay). Nevertheless, the analysis of the fish data at the species level provided the most convincing evidence of site separation, albeit slight.

TRAWL SERIES V

This series was undertaken to enable more critical assessment of the community structure than was afforded by the binary data of series I and consisted of a tight grid of stations consistently sampled. Quantitative counts of species numbers were made. From the dendrogram (Fig. 5a) three site groups were accepted from the classification after transformation of the data (square root), thus:

I 1,5,6,8,10 and 11
II 2 and 7
III 3,4,9,12,13 and 14

The results of ordination (Fig. 5b) support these three groups.

The Cramer measure provided evidence of which species contributed to the groupings; this together with the dissimilarity measure indicated that group I was characterised by the fish *Upenaeus sulphureus* and *Pomadasys argyreus* and to a lesser extent *Priacanthus tayenus* and *Apogon fasciata* as well as the crab *Portunus gracilimanus*. Overall, however, this region shares most of its fauna with the group III sites differing mainly in being considerably less diverse. The group II sites lacked much of the fauna of the other sites (especially site 7 which was quite depauperate), but contained several sponges and echinoderms not found elswhere. By contrast the group III sites were rich in fauna: again fish appeared the dominant influence and the more important taxa were *Trachinocephalus myops*, *Synodus variegatus*, *Saurida undosquamis*,

Engyprosopon grandisquama and *Pristotis (Daya) jerdoni*. A few other invertebrate taxa contributed to the group separation, viz. *Comatula* spp. (Echinodermata), *Portunus* spp. (Crustacea) and some sponges.

Examination of influences upon ordination showed that fish again were dominant notably *Saurida tumbil*, *Nemipterus* sp. *Upeneus sulphureus*, *Priacanthus tayenus*, *Apogon fasciata* and *Pomadasys argyreus* which as well as the crab *Portunus gracilis* strongly influenced the pattern positively (i.e. contributed to group I sites). In contrast the fish *Synodus variegatus*, *Trachinocephalus myops*, *Saurida undosquamis*, the crabs *Portunus tenuipes* and *P. argentatus* together with the cephalopod *Sepia pharaonis* showed a strong negative influence (i.e. contributed to the group III sites).

All three site goups were considered in relation to depth, distance from shore and carbonate concentration of their sediments. These parameters are clearly correlated with one another. Table 1 shows data for depth and distance from shore and Fig. 4c shows the distribution of carbonates.

TABLE 1. The depth, distance from shore in nautical miles, and zone of site groups from series V.

Site group	Depth (m)	Distance (n. miles)	Zone
I	21.9 9–55.8	6 2–19	Inshore
II	28.8 27–30.6	12.5 11–14	Transitional
III	42.8 30.6–57.6	23 12.5–32	Offshore

It can be seen that mean depth is reflected in distance from shore and that carbonate concentrations largely parallel these parameters (Fig. 4c). Sites 1,5 and 10 are shallow inshore sites high in terrigenous sediments, sites 6 and 11 are

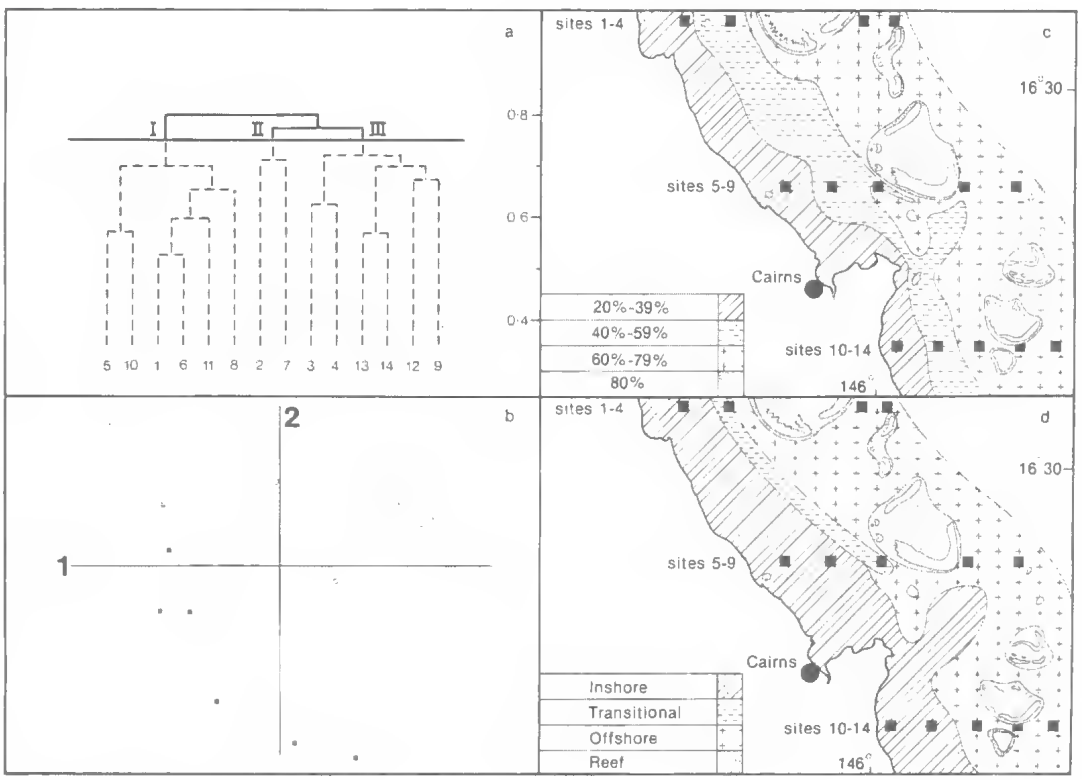

FIG 5. Analysis of sites from series V.
a. Classification
b. Ordination
I = ○, II = △, III = ■.
c. Distribution of sites in relation to carbonate content of sediments (after Maxwell, 1968).
d. Interpreted 'zonation' of reef in Cairns area.

slightly farther out with intermediate carbonate levels. Sites 2 and 7 also lie in the intermediate carbonate region. Sites 3,4,9,12,13 and 14 all clearly lie in the high carbonate region and are also farther out and deeper. Site 8 is somewhat anomalous: it is on the outer edge of Arlington Reef, is one of the deepest sites and lies in a high carbonate zone. Nevertheless, examination of Fig. 4c shows it lies just at the edge of an inshore extrusion through the Grafton Passage. In the analysis sites 9 and 12 showed a close affinity; these lie on the approximate southern edge of the Grafton Passage.

We conclude from these data that a broad inshore/offshore pattern occurs in the Cairns region. It is one related to depth and distance from shore, but appears influenced by sediment type and presumably currents. A 'zonation' is presented in Fig. 4d where a broad inshore component extends as a tongue through the Grafton Passage reflecting sediment type rather than depth or distance from shore. The reality of the transitional zone is questionable. Perhaps there are odd pockets of peculiar habitat or perhaps further sampling would blur these distinctions. Finally, earlier analysis of the untransformed data revealed a simpler chaining of sites from inshore to offshore with little discrimination, i.e. a relatively homogenous pattern with diversity attenuating towards the shore.

DISCUSSION

Central to the process of establishing the presence of biological zonation within the Great Barrier Reef Region is the debate over the structure of communities. There have been two schools of thought surrounding communities: one considers them structured, rigid groupings with well defined boundaries maintained by competition, the other as a variety of species spread along environmental continua — their individual abundances determined by environmental suitability. In work on marine benthos the debate arose when the classification of benthic fauna in shallow, tropical waters failed to completely support the definitive work of Peterson (1914, 1915, 1924) and Thorson (1957). Stephenson (1973) presented a thorough appraisal of methods and arguements concerning marine benthic community analysis and, furthermore, re-analysis of Petersen's original data by Stephenson, Williams and Cook (1972) only supported some of Petersen's original interpretations. As a consequence the more traditional concept of a structured community must be weakened. A similar debate has been pursued in the botanical literature with the strong phytosociology school of the Europeans countered by the advocacy of the Americans for the continuum concept (see McIntosh, 1967 for a review).

In all the analyses of series I we see evidence of a great deal of homogeneity. Furthermore, there is little consistency between analyses regarding specific site groupings. The exception is the Princess Charlotte Bay sites which, because most of the trawls were conducted with different gear, may be justifiably excluded from further consideration. Nevertheless, analyses involving just the fish, but conducted at the species level, did indicate a broad inshore/offshore (shallow/deep) pattern.

Our results from the smaller scale series V sampling, which was carried out in a systematic and quantitative manner, do suggest the continental shelf in the Cairns area has two broad zones (inshore/offshore) related to sediment type and the correlated factors of depth and distance from shore. The taxa that best differentiated these zones were the 'errant' taxa of which fish are dominant. Indeed, in the various analyses certain taxa consistently appeared to strongly influence the results. Rainer and Munro (1982) used only fish and cephalopods in their study of the Gulf of Carpentaria in which they concluded similarly that a broad depth related (inshore/offshore) pattern existed.

It could be argued that the fish alone are sufficient to determine patterns. Trawling, however, is designed to collect demersal fauna, notably fish and prawns, and not to collect the epibenthic fauna. That it does catch this fauna is undeniable, but it is not designed to sample them accurately. Our conclusions that these components of the fauna are not as definitive as the fish in determining patterns reflects method rather than necessarily biological reality. No doubt rigorous sampling of the bottom with dredge and grab would reveal increased resolution of assemblages within the benthos. It could be argued that if clearly definable discontinuities existed in epibenthic fauna a reflection would be expected to occur in the associated demersal fauna. Emus are found on plains, cassowaries in forests. Our analysis based upon fauna sampled effectively with a trawl net (i.e. fish) suggests such clear discontinuities do not exist, at least in the inter-reef regions of the northern part of the Great Barrier Reef.

We believe the analyses have some important practical implications: they are that since fish (and

selected other species e.g. prawns) are effectivley sampled they are likely the only ones worth sampling. Also fish are relatively easily sampled by trawling and are certainly more reliably identified than most invertebrates. Depending upon the geographical scale of the survey, the fishes alone may provide sufficient evidence of bottom type and faunal assemblages. Certainly McKay (1970) found that in Exmouth Gulf, Western Australia, catches of banana prawns were generally associated with the presence of the fish *Polydactylus specularis*.

Ordinations of the large Series I data set revealed vast areas of 'likeness' in terms of taxonomic composition. It was not possible to define a unique community type comprised of taxa which were generally absent or rare outside it's boundaries. Instead, classifications were based on often subtle differences between large and diverse taxonomic suites which were geographically widely distributed (see Appendix 2), i.e. collections were indicative of a continuum although some confidence might be placed upon the fish.

Rainer (1984), after further examination of the data of Rainer and Munro (1982), concluded that although a basic depth related pattern existed it did show some seasonal shift (to deeper regions in September compared to March). He suggested the entire fish (and cephalopod) population was in a continual flux. Poiner and Harris (1985) reported on further trawling in the Gulf of Carpentaria in 1983. Their analyses of similar assemblages of fish and cephalopods revealed 'The site groups for each month make a coherent (inshore, offshore) topographical picture and conform reasonably well with the patterns detected by Rainer (1984) for the 1963/4 data set' MS p. 11. Thus there appears a basic agreement between both recent and past patterns within the Gulf of Carpentaria. Furthermore, our east coast data appear to conform to this same pattern. It may be that an inshore/offshore pattern is stable despite slight seasonal changes or others created by the advent of commercial trawling. The absence of clearly delineated assemblages, i.e. the presence of a continuum, we believe reflects a true biological phenomonen.

Differentiation of the Gulf of Carpentaria data was only achieved at a relatively high level of dissimilarity and this may have been aided by the ability to trawl over larger areas less restricted by 'foul ground'. Should it become possible to carry out broader based sampling over much of the Great Barrier Reef Region including 'foul' ground, then we would expect to find an extension of our depth related zonation pattern north and south from the Cairns area.

In conclusion, if the assumption is correct that demersal fauna, predominantly fish, should refelect any major patterning of bottom communities, then, where conditions allow trawling, a fairly homogeneous assemblage occurs throughout large areas of the Great Barrier Reef. This continuum is broadly separable into a relatively rich offshore fauna and an inner, shallower component which is relatively depauperate, but has some characteristic species. Such a pattern may characterise much of the shallow tropical shelf of northern Australia.

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APPENDIX I

SUMMARY OF STATION DATA FOR TRAWL SERIES **O — VI**
(NA = Not available)

TRAWL SERIES O (19 Feb to 21 Feb 1979)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
A	16°36.2'	145°44.5'	32.4	Mud
B	16°37.5'	145°44.8'	27.0	Mud
C	16°47.4'	145°52.2'	27.0	Mud
D	16°44.6'	145°53.9'	36.0	Mud
E	16°43.7'	145°49.0'	43.2	Sand, mud
F	16°45.0'	146°02.1'	54.0	Sand, mud
G	16°51.9'	146°07.1'	43.2	Mud
H	16°47.4'	146°07.5'	48.6	Shell
I	16°44.5'	146°12.2'	63.0	Sand, mud
J	16°39.9'	146°10.8'	92.0	Sand, sponge, coral
K	16°34.6'	146°12.4'	81.0	Sand, shell, *Halimeda*

TRAWL SERIES I (9 Oct to 4 Nov 1979)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
1	18°35.0'	145°49.5'	45.0	NA
2	18°19.0'	147°04.0'	75.6	NA
3	18°17.0'	146°31.0'	30.6	Coral rubble
4	17°43.8'	146°26.7'	41.4	NA
5	17°38.4'	146°34.0'	57.6	NA
6	17°38.0'	146°33.0'	59.4	Shell, weed
7	17°37.0'	146°34.0'	63.0	NA
8	17°36.8'	146°36.8'	64.8	NA
9	17°34.0'	146°27.5'	59.4	Shell, coral rubble
10	17°33.0'	146°26.0'	46.8	Coral rubble
11	17°31.0'	146°19.5'	41.4	NA
12	17°14.0'	146°27.0'	39.6	NA
13	17°13.5'	146°22.5'	48.6	Coral rubble
14	17°13.5'	146°17.0'	37.8	Coral rubble
15	17°11.0'	146°29.0'	66.6	Coral rubble
16	17°09.8'	146°23.5'	50.4	NA
17	17°08.0'	146°15.0'	41.4	Clean sand
18	17°08.7'	146°15.2'	43.2	NA
19	17°05.5'	146°16.0'	52.2	NA
20	17°05.0'	146°23.0'	50.4	NA
21	17°02.0'	146°25.2'	64.8	Coral rubble
22	17°01.5'	146°19.0'	48.6	NA
23	17°01.0'	146°20.0'	48.6	NA
24	17°00.5'	146°01.5'	22.5	Sandy, clean

25	16°59.5'	146°06.2'	37.8	Hard bottom
26	16°57.3'	146°18.7'	57.6	Mud
27	16°53.5'	146°18.0'	68.4	Coral rubble
28	16°53.2'	146°08.6'	43.2	Hard bottom
29	16°50.0'	146°11.5'	46.8	NA
30	16°48.2'	146°07.5'	49.5	Clean bottom
31	16°46.6'	146°07.0'	55.8	Coral rubble, mud
32	16°46.0'	146°03.8'	39.6	Clean sand
33	16°44.4'	146°12.0'	54.0	Mud
34	16°41.9'	146°11.2'	64.8	Clean
35	16°34.6'	145°52.6'	37.8	Coral rubble
36	16°34.5'	145°46.6'	30.5	Clean
37	16°33.3'	145°39.4'	22.5	Clean, hard
38	16°30.2'	145°56.4'	45.0	Clean sand
39	16°30.4'	145°52.4'	42.3	Clean sand
40	16°25.2'	145°31.8'	17.1	NA
41	16°15.2'	145°37.6'	39.6	NA
42	16°08.0'	145°37.0'	43.2	NA
43	16°04.2'	145°37.5'	30.6	NA
44	15°59.3'	145°32.4'	28.8	NA
45	15°46.6'	145°42.1'	48.6	NA
46	15°46.3'	145°35.8'	27.0	NA
47	15°46.2'	145°34.2'	27.0	NA
48	15°45.4'	145°40.2'	43.2	Clay, mud
49	15°44.9'	145°40.9'	46.8	Clay, mud
50	15°44.8'	145°34.2'	39.6	NA
51	15°42.7'	145°28.5'	27.0	Coral rubble
52	15°36.2'	145°26.8'	21.6	NA
53	15°23.3'	145°29.0'	28.8	Clean, hard
54	15°13.3'	145°27.1'	30.6	Clean
55	15°06.0'	145°29.4'	34.2	Clean, hard
56	14°48.0'	145°25.0'	28.8	NA
57	14°42.0'	145°04.5'	9.0	NA
58	14°40.0'	145°07.5'	10.8	NA
59	14°39.0'	145°20.0'	19.8	Mud, shell
60	14°38.5'	145°13.0'	13.5	NA
61	14°36.0'	145°03.0'	12.6	NA
62	14°35.3'	145°23.0'	27.0	Mud, shell
63	14°32.2'	145°07.5'	19.8	NA
64	14°27.8'	144°51.0'	12.6	Clean, hard
65	14°26.5'	144°44.0'	12.6	Mud, weed
66	14°23.9'	144°42.1'	18.0	Mud
67	14°20.2'	144°51.0'	23.4	Rubble
68	14°12.0'	144°03.0'	18.9	NA
69	14°12.0'	144°04.3'	18.9	NA
70	14°12.0'	144°05.8'	21.6	NA
71	14°11.5'	144°06.9'	21.6	NA
72	14°11.4'	144°02.0'	19.8	Clean
73	14°11.0'	144°25.4'	6.3	Mud
74	14°10.8'	144°02.0'	18.9	Shell
75	14°10.8'	144°05.9'	21.6	Clean
76	14°10.8'	144°04.2'	23.4	Clean
77	14°10.7'	144°02.3'	21.6	Clean, shell
78	14°10.6'	144°08.6'	21.6	Clean
79	14°10.4'	144°01.3'	21.6	Clean, shell
80	14°10.4'	144°09.4'	21.6	Clean
81	14°10.4'	144°08.4'	21.6	Clean
82	14°10.0'	144°01.2'	21.6	Clean
83	14°10.0'	144°01.2'	22.5	Mud, shell
84	14°09.6'	144°02.0'	21.6	NA
85	14°09.6'	144°05.3'	21.6	Rubble
86	14°09.3'	144°03.3'	22.5	Rubble
87	14°08.8'	144°24.5'	18.9	Hard, clean
88	14°07.1'	144°26.4'	22.5	Clean
89	14°05.3'	144°04.7'	25.2	Coral
90	14°04.1'	144°26.1'	30.6	Mud
91	14°01.0'	143°56.6'	27.0	Mud
92	14°01.0'	144°10.4'	34.2	NA
93	14°00.9'	143°54.5'	25.2	Shell
94	13°58.9'	144°14.9'	37.8	Mud, shell
95	13°55.4'	143°48.6'	21.6	Clean, hard
96	13°52.2'	143°51.6'	30.6	Mud
97	13°45.1'	143°48.2'	18.0	Mud, shell
98	13°44.3'	143°48.0'	18.0	Shell
99	13°38.6'	143°42.6'	25.2	Mud, shell
100	13°37.0'	143°44.9'	19.8	Clean
101	12°45.6'	143°32.2'	19.8	Mud
102	12°42.5'	143°28.8'	14.4	Clean
103	12°40.2'	143°28.8'	21.6	Soft, shell
104	12°35.0'	143°25.7'	21.6	Clean, hard
105	12°34.5'	143°24.6'	16.2	Clean
106	12°34.1'	143°23.4'	14.4	Mud
107	12°34.0'	143°24.7'	18.9	Mud, shell
108	12°33.1'	143°22.5'	14.4	Hard, clean, shell
109	12°31.3'	143°25.8'	28.8	Mud, shell
110	12°29.7'	143°20.3'	18.0	Hard, shell
111	12°26.5'	143°22.6'	24.3	Clean, hard
112	12°26.2'	143°22.4'	24.3	Hard, sand
113	12°26.3'	143°19.7'	18.0	Sand
114	12°20.1'	143°16.6'	15.3	Mud, shell
115	12°16.8'	143°10.2'	12.6	Clean, hard
116	12°11.6'	143°10.1'	18.0	Mud
117	12°06.4'	143°10.1'	15.3	Shell
118	12°06.4'	143°17.6'	37.8	Hard
119	12°05.6'	143°13.3'	29.7	Hard
120	12°01.8'	143°13.3'	15.3	Mud
121	11°53.8'	143°12.2'	30.6	Hard, weed
122	11°47.2'	143°11.4'	34.2	Mud
123	11°45.2'	143°03.0'	19.8	Clean, hard
124	11°41.8'	143°08.3'	32.4	Hard, smooth

TRAWL SERIES II (20 June to 28 June 1980)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
1	22°15.5'	152°43.5'	36.0	Flat, clean
2	22°15.7'	152°41.1'	61.2	Rubble
3	22°16.8'	152°40.5'	50.4	Flat, clean
4	22°08.4'	152°35.5'	50.4	NA
5	22°02.1'	152°27.7'	57.6	NA
6	21°53.2'	152°19.7'	57.6	NA
7	21°40.2'	152°14.7'	54.0	NA
8	21°40.0'	152°10.3'	61.2	NA
9	21°38.3'	152°04.5'	57.6	Sand, weed
10	21°40.2'	152°04.2'	63.0	NA
11	21°44.0'	152°04.0'	54.0	NA
12	21°46.9'	152°50.0'	54.0	NA
13	21°45.2'	152°01.2'	48.6	NA
14	21°50.1'	152°02.5'	59.4	NA
15	21°50.2'	152°09.6'	43.0	NA
16	21°52.4'	152°12.6'	52.0	NA
17	21°58.6'	152°16.2'	50.4	NA

TRAWL SERIES III (13 Sept to 4 Oct 1980)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
1	26°31'	153°48'	480	—
2	26°20'	153°53'	300	—
3	25°27'	153°46'	330	—
4	25°11'	153°45'	330	—
5	23°59'	152°47'	320	—
6	23°28'	153°19'	562	—
7	23°30'	153°04'	540	—
8	23°11'	153°00'	420	—
9	22°10'	154°10'	570	—
10	22°09'	153°55'	400	—

11	21°30'	152°56'	240	—
12	21°41'	152°51'	150	—
13	24°05'	152°53'	315	—
14	23°58'	152°45'	212	—
15	23°50.6'	152°36.2'	270	—
16	23°42.5'	152°24.8'	216	—
17	23°36.6'	152°22.9'	205	—
18	23°26'	152°16'	205	—
19	23°36.3'	152°43.2'	360	—
20	23°10.6'	152°12.3'	135	—
21	22°56.1'	152°32.2'	144	—
22	22°51.7'	152°45.7'	261	—
23	22°54.5'	152°12.5'	351	—
24	23°00.3'	153°18.8'	387	—
25	22°36.7'	154°14.0'	522	—
26	23°15.3'	154°21.7'	549	—

TRAWL SERIES IV (8 Oct to 10 Oct 1980)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
1	16°48.8'	145°58.4'	41.0	—
2	16°46.3'	145°57.9'	40.0	—
3	16°44.5'	145°56.5'	30.0	—
4	16°42.8'	145°56.3'	39.0	—
5	16°44.3'	145°59.4'	45.0	—
6	16°44.0'	145°59.6'	47.0	—
7	16°43.9'	146°00.7'	51.0	—
8	16°44.8'	146°02.1'	50.0	—
9	16°45.6'	146°01.5'	40.0	—
10	16°47.0'	145°58.9'	45.0	—
11	16°48.5'	145°59.6'	50.0	—
12	16°48.9'	146°00.4'	50.0	—
13	16°48.8'	146°01.2'	36.5	—
14	16°48.5'	146°02.5'	36.5	—
15	16°48.1'	146°03.7'	40.0	—
16	16°46.8'	146°04.9'	41.0	—

TRAWL SERIES V (21 Jan to 28 Jan 1981)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
1	16°23.0'	145°30.8'	14.4	Clean, hard, sandy
2	16°23.0'	145°37.0'	27.0	Clean
3	16°23.0'	145°55.6'	50.4	NA
4	16°23.0'	146°01.6'	57.6	Silt, shell debris
5	16°43.0'	145°43.0'	10.8	Some weed
6	16°43.0'	145°49.2'	19.8	Clean
7	16°43.0'	145°55.4'	30.6	Some weed
8	16°43.0'	146°07.8'	55.8	Clean
9	16°43.0'	146°13.8'	42.5	Weed
10	17°03.0'	145°55.6'	9.0	Clean
11	17°03.0'	146°01.7'	21.6	Clean
12	17°03.0'	146°07.8'	30.6	NA
13	17°03.0'	146°14.0'	36.0	Clean
14	17°03.0'	146°20.0'	39.6	Clean

TRAWL SERIES VI (25 April to 5 May 1982)

Stn	Lat. (S)	Long. (E)	Depth (m)	Bottom Type
1	17°00'	145°55.0'	10.0	—
2	17°00'	145°57.0'	20.0	—
3	17°00'	146°00.0'	25.0	—
4	17°00'	146°03.0'	30.0	—
5	17°00'	146°05.8'	35.0	—
6	17°00'	146°21.1'	55.0	—
7	17°00'	146°24.5'	55.0	—
8	17°00'	145°58.0'	22.0	—
9	17°00'	146°01.0'	23.0	—
10	17°00'	146°04.5'	34.0	—
11	17°00'	146°07.0'	35.0	—
12	17°00'	146°08.0'	42.0	—
13	17°00'	146°08.5'	30.0	—
14	17°00'	146°17.5'	58.0	—
15	17°00'	146°18.4'	55.0	—
16	No sample			
17	16°59.0'	146°19.0'	53.0	—
18	17°00'	146°26.0'	52.0	—
19	17°00'	146°27.0'	35.0	—
20	16°45.0'	146°18.5'	50.5	—
21	16°45.0'	146°12.5'	31.0	—

APPENDIX II

CHECKLIST OF FAUNA FROM TRAWL SERIES O — VI

PORIFERA

Adociidae	
Adocia sp.	III(15, 18)
Sigmadocia sp.	III(26)
Anchinoidae	
Anchinoidae sp.	I(52)
Aplysillidae	
Aplysilla sp.	V(2, 9)
Darwinella sp.	I(41)
Darwinellopsis sp.	I(14)
Aplysillidae sp.	II(3) V(12)
Aplysinellidae	
Aplysina sp.	I(5)
Psammaplysilla sp.	V(2)
Pseudoceratina sp.	II(2, 5)
Aplysinellidae sp.	I(50)
Axinellidae	
Acanthella sp.	I(51, 60, 61, 115) IV(7) V(9)
Axiamon folium	I(63) VI(7)
Axinella sp.	IV(1)
Axinectya mariana	V(5)
Raphoxya pallida	I(–)
Axinellidae spp.	O(1) I(35, 63) IV(1) V(9)
Biemnidae	
?*Biemna* sp.	I(52)
Callyspongiidae	
Callyspongia ?confederata	I(4, 42, 44) V(12)
C. subarmigera	I(97, 115, 117)
C. ?subarmigera	V(2)
Callyspongia spp.	I(2, 4, 5, 14, 26, 58) I(4, 5, 11) III(2, 4, 5, 14)
?*Euplacella* sp.	I(115)
Siphonochalina spp.	I(4, 114) II(5) V(2, 4, 9)
?*Siphonochalina* spp.	V(2, 4, 9)
Toxochalina sp.	I(4, 14)
Callyspongiidae sp.	O(E) I(27, 97, 115, 116) IV(5) VI(7)
Chondrosiidae	
Chondrilla australiensis	V(2)
Chondrilla sp.	II(2)
Chondrosiidae sp.	I(13, 80, 102) II(1, 8) V(7)
Clionidae	
Clionidae sp.	I(63) V(2) VI(7)
Coelosphaeridae	
Histoderma sp.	III(18)
Desmacellidae	
Kerasemna horrida	I(44)

Desmacidonidae
Desmapsamma sp. V(9)
Farcepia sp. V(2)
Liosina sp. I(56)
Desmoxyidae
Higginsia sp. I(63)
Dictyodendrillidae
?*Dictyadendrilla* spp. V(3)
Dictyodendrillidae spp. O(I, K) I(4, 21, 27, 51, 56) II(3) VI(11, 14)
Dysideidae
Dysidea spp. I(44, 51, 56, 58, 100) V(3, 7)
Spangianella spp. V(2, 9)
Dysideidae spp. O(K) V(3)
Geodiidae
Geodia cf. *regina* III(8, 13)
Geodia spp. III(8, 19) V(9, 12)
Halichondridae
?*Ciocalypta* sp. III(19)
Halichandria spp. O(E, F, J) I(43, 52, 66) IV(4, 9,) V(12)
Rhaphisia sp. V(2, 12)
?*Trachyapsis* sp. V(9)
Halichondridae spp. I(41, 51, 52, 113)
Haliclonidae
Haliclona spp. I(4, 5, 56, 60) III(4) V(6, 9)
?*Reniera* sp. I(69)
?*Sigmadacia* sp. I(4, 5, 37, 51, 52, 53)
Haliclonidae spp. O(D) I(27, 63) VI(7)
Halisarcidae
Halisarcidae sp. VI(14)
Hemiastrellidae
Vibulinus sp. I(51)
Heterocoelidae
?*Aphracerus* sp. I(103)
Leucettusa sp. I(35) IV(2, 26, 7)
?*Leucettusa* sp. IV(4)
Heterocoelidae spp. IV(2)
Homocoelidae
Leucosolenia sp. V(9)
Hyalonematidae
Hyalonema sp. III(25)
Pheranema spp. III(10, 19)
Hyalonematidae sp. III(19)
Hymeniacidonidae
Hymeniacidan sp. III(19)
Hymeniacidonidae spp. I(11, 49, 59) V(9, 12)
Ianthellidae
?*Bajalas* sp. II(11)
Ianthella basta II(15)
Ianthella sp. III(–)
Ianthellidae sp. III(14)
Jaspidae
Jaspis sp. I(25, 35) V(2)
Leucettidae
Leucettidae spp. II(2, 7, 8, 10, 11, 14)
Microcionidae
Acarnus erithacus I(9)
A. topsenti I(57)
Clathria hartmeyeri I(14)
C. rotunda III(4)
Clathria spp. I(14, 52, 55, 119) IV(6) V(2)
Echinachalina anomala V(4)
Echinochalina intermedian I(14)
?*Echinochalina* spp. I(29, 72)
Echinoclathria sp. I(72) III(1)
Isaciana taberosa I(4, 14, 55)
Microcionidae sp. V(12)
Mycalidae
Mycale tylstrongyla I(52)
Mycalidae sp. II(5)
Myxillidae
Ectamyxilla sp. I(41)
Lissodendoryx spp. I(20) II(8, 13)
Myxillidae sp. I(41)
Nepheliospongidae
Nepheliospondiae sp. III(10)
Niphatidae
Amphimedan spp. I(2, 4, 44, 53, 63) III(5, 6, 13)
Cribrochalina spp. I(43) II(–)
Gelliodes fibulata I(97)
Niphates spp. I(38) II(5, 14, 17) V(9)
Niphatidae sp. O(C, D) I(51, 97) IV(1) VI(7, 13)
Oceanapiidae
Biminia sp. I(122)
Calyx sp. I(51)
Pachypellina sp. II(6)
Oceanapiidae sp. V(12)
Petrosiidae
Xestaspangia sp. I(113)
Phorbasidae
Echinodictyum caralinaides I(61)
?*Myrmekiaderma* sp. I(11, 60, 63)
Pollacidae
Semperella cf. *schultzei* III(7, 10, 11, 26)
Pollacidae sp. III(19)
Psammascidae
?*Holapsamma* sp. I(4, 41)
Psammascus chaliniformis I(10, 26, 35)
?*Psammapemma* spp. I(26) V(9, 12)
Psammascidae sp. II(8, 10, 11)
Raspailiidae
Raspailia sp. IV(12)
Sigmaxinellidae
Sigmaxinellidae sp. I(51)
Spirastrellidae
Spirastrella ?*montiformis* I(61)
Spirastrella sp. IV(4) V(2)
Spirastrellidae spp. I(52, 64)
Spongiidae
Cacaspangia spp. I(41, 43) V(2, 9)
?*Carteriospangia* sp. V(2)
Cascinoderma spp. II(1, 6, 7, 13, 14, 15) IV(6) V(9, 12)
Dactylospangia sp. V(2, 12)
Hippaspongia aphroditella I(61)
Hippospangia sp. V(2) VI(18)
?*Hippospongia* sp. I(52)
?*Hyattella* spp. I(58, 79) V(12)
?*Leiasella* sp. I(11)
Spongia spp. I(26, 46) II(5) III(10, 19) V(9)
Spongiidae spp. O(D, I) I(21, 43) III(4, 10) IV(–) V(9) VI(7)
Stellidae
Myriastra sp. I(97)
Stelletta cf. *maxima* III(19)
Stelletta spp. III(8, 13, 15, 18, 19, 25)
Stellettidae spp. O(E, J) I(42)
Suberitidae
Aaptas sp. IV(12)
?*Laxosuberites* sp. I(–)
?*Terpias* sp. I(115)
Tedaniidae
Iatrachata baculifera I(61, 89)

I. coccinea I(35)
Tedania sp. V(4)
Tethyidae
Tethya sp. II(17)
Tethyidae sp. I(7)
Tetillidae
Cinachyra sp. V(9)
?*Cinachyra* sp. III(19)
Craniella simillima I(–)
Craniella sp. III(8, 19) IV(9, 12) V(9)
Raphidotethya enigmata V(9)
Raphidotethya spp. I(9, 14) IV(2)
Tetillidae spp. O(K) IV(4, 8)
Thorectidae
?*Fascaplysinopsis* sp. II(13)
?*Fasciospongia* sp. I(14)
Hyrtios spp. I(35, 51, 52, 62, 115) II(10, 11)
Ircinia spp. I(4, 14, 35, 60, 62, 72, 76, 89, 92) III(11) V(8)
Psammocinia spp. II(2, 10, 11, 13, 14)
Sarcotragus spp. I(9) II(13) V(4)
?*Sarcotragus* sp. III(14)
Smenospongia sp. I(35)
Thorecta sp. I(55) V(2)
Thorectidae spp. O(D, E) I(27, 51, 52, 60, 86) II(2, 11, 12) V(4) VI(6, 7)

CNIDARIA

Acanthogorgiidae
Acalycigorgia sp. I(97)
Acanthogorgia sp. III(26)
Muricella sp. III(22)
?Acanthogorgiidae sp. I(122)
Acroporidae
Acropora spp. I(43) IV(1, 2)
Montipora sp. I(42)
Agariciidae
Leptoseris sp. I(43)
Alcyoniidae
Sarcophyton sp. I(43) V(9)
?*Sinularia* sp. I(63, 103, 112)
Sinularia sp. I(43)
Anthothelidae
Alertigorgia orientalis I(107, 111, 114, 116, 120)
?*Iciligorgia* sp. O(J)
Solenocaulon sp. O(B, I) I(38, 77) IV(1)
Antipathidae
Antipathes spp. I(2, 14, 38, 43)
Cirripathes spp. O(J) I(3, 14, 70, 72, 74, 86, 89, 90, 97, 98, 101, 110, 112)
Parantipathes sp. I(2, 31, 42)
Antipathidae sp. I(121)
Briareidae
Briareidae sp. V(9)
Caryophyllidae
Euphyllia sp. I(58)
Stephanotrochus sp. III(26)
Caryophyllidae sp. III(8)
Chrysogorgidae
Chrysogorgia spp. III(6, 8, 25)
Clavulariidae
?*Clavularia* sp. I(97)
Coralliidae
Coralliidae sp. III(22)
Dendrophylliidae
Balanophyllia sp. I(119)
Dendrophyllia cf. *miniscula* III(21)
Dendrophyllia spp. I(20, 29) III(–)
Turbinaria spp. I(43, 64)
Ellisellidae
Ellisella sp. O(J) I(114)
Junceella ?gemmacea I(31)
Nicella sp. I(42) II(8)
Epizoanthidae
Epizoanthus sp. III(25, 26)
Faviidae
Caulastrea furcata O(K)
Favites sp. II(7)
Plesiastrea sp. I(51, 103)
Flabellidae
Flabellum sp. II(7) III(23, 25, 26)
?*Gardineria* sp. I(4, 18, 41, 42, 51, 56, 58, 107, 115) IV(1, 12)
Placotrochus sp. IV(1, 2, 6, 12)
Fungiidae
Cycloseris ?cyclolites I(52, 57, 60, 64, 103)
Cycloseris sp. I(51, 101)
Diaseris sp. O(K)
Gorgoniidae
Lophogorgia sp. O(J)
Isididae
Keratoisis sp. III(10)
Lafoeidae
Acryptolaria sp. III(26)
?*Zygophlax* sp. I(1)
Melithaeidae
Melithaeidae sp. V(2)
Milleporidae
Milleporidae sp. IV(1)
Nephtheidae
Capnella sp. II(8, 13)
Dendronephthya ?brevirama I(7, 18, 42, 45, 52, 61, 89, 92, 112, 119)
D. mollis II(12)
D. ?mollis II(2, 8, 19, 22, 28, 43, 45, 52, 112)
Dendronephthya spp. O(J) I(29) IV(4, 5, 7, 12, 16)
?*Dendronephthya* sp. II(8)
Nephthea sp. V(9)
Umbellulifera sp. I(74)
Nephtheidae spp. I(34, 43) IV(1) III(11)
Nidaliidae
Siphonogorgia sp. O(J)
Paralcyoniidae
Studeriotes sp. I(58)
Paramuricidae
Muricella sp. III(22)
Pennatulidae
Pennatula sp. III(10)
Pennatulidae sp. III(1, 2, 6, 7, 8, 23, 26)
Plexauridae
Echinogorgia sp. I(26)
Eunicea sp. III(20)
Euplexaura ?robusta I(97, 122)
Pseudoplumarella echidna I(43)
Plexauridae sp. II(2)
Plumulariidae
Aglaophenia sp. III(25, 26)
?*Aglaophenia* sp. II(6, 12) IV(12)
Gymnangium cf. *gracicaule* II(7)
G. longicornus I(111, 118) V(3)
G. cf. *longirostre* II(8)
Lytocarpus sp. O(B, F, 1, J, K) I(87, 91, 120) V(5)
Thecocarpus sp. III(8)

Poritidae
- *Alveopora marlensi* O(K)
- *Alveopora* sp. I(51)

Primnoeidae
- *Callogorgia* spp. III(6)
- *Narella* sp. III(10)
- *Plumarella* sp. III(6,7)
- *Thouarella* cf. *hilgendorfi* III(6)
- *Thouarella* sp. III(10)
- Primnoeidae sp. III(6, 22, 25)

Pteroeididae
- *Pteroeides* spp. I(90, 111, 112)

Sertulariidae
- ?*Salacia* sp. II(2)
- *Sertularella diaphana* II(2)
- *S. ?diaphana* I(72, 101)
- ?Sertulariidae sp. I(112)

F.Subergorgiidae
- *Subergorgia verriculata* I(26, 114)
- *Subergorgia* sp. V(9)
- Subergorgiidae sp. IV(1)

Syntheciidae
- *Synthecium ?patulum* I(92)
- *Synthecium* spp. O(F, I, K) I(41, 97, 101) V(3)

Telestidae
- *Telesto rubra* O(1)
- *Telesto* sp. O(1)
- ?*Telesto* sp. I(31)

Trachyphylliidae
- *Trachyphyllia geoffroyi* I(58, 61, 63, 64, 101) II(7, 15, 16)

Veretillidae
- *Lituaria australasiae* O(B)

Virgulariidae
- *Scytalium* spp. I(44, 48, 116)

Xeniidae
- *Xenia* spp. V(9)

Zoanthidae
- *Sphenopus marsupialis* O(B, F, J) I(1, 2, 4, 6, 10, 11, 22, 32, 42, 45, 56, 58, 63, 112, 118, 119) V(12, 13)

Undetermined
- Actinaria spp. I(101) III(6, 7, 15, 17, 22, 25, 26)

MOLLUSCA

Anomiidae
- ?*Patro australis* I(5, 49)
- ?Anomiidae sp. I(101)

Aplysiidae
- Aplysiidae sp. I(35)
- ?Aplysiidae sp. III(1)

Arcidae
- *Arca subnavicularis* I(93, 96, 97, 101, 102, 113, 118, 119) II(8)
- *Arca* sp. IV(16)
- *Cucullaea labiata* I(96)
- *Opularca tennella* I(59, 92, 93, 97, 110, 119, 121) IV(8)
- *Trisidos semitorta* I(93, 119)

Argonautidae
- *Argonauta* sp. III(25)

Arminidae
- ?*Armina* sp. III(1)

Bursidae
- *Bursa rana* I(9, 13, 22, 48, 56, 79, 89, 97, 104) VI(6, 8, 12, 16)
- *Bursa* sp. O(H)

Cardiidae
- *Fragum fragum* IV(16)
- *Fragum* sp. I(22)
- *Hemicardium ?subretusum* I(124)
- *Nemocardium probatum* I(4)
- *Plagiocardium setosum* IV(6)

Cassidae
- *Phalium bisulcatum* I(14) IV(8)

Chamidae
- *Chama pulchella* I(52, 93, 97, 98, 101, 119)
- *C. reflexa* I(103)
- *Chama* spp. I(55, 117)

Conidae
- *Conus cancellata* I(14)
- *C. planorbis* I(3)

Corbulidae
- *Aloidis hydropica* I(66, 90) V(5, 14)

Cymatiidae
- *Cymatium pfeifferianas* I(10, 41, 56, 64, 64, 102, 111, 115) IV(5, 6, 12, 16) VI(4, 6)
- *Distorsio reticulata* I(9, 11, 22, 26, 48, 49, 96, 97, 112) IV(9, 12) V(1) VI(5, 6)
- *Gyrineum* sp. IV(8)
- ?*Linatella* sp. I(115)
- *Ranularia caudata* I(2, 11, 28)

Cypraeidae
- *Cypraea labrolineata* IV(8)
- *C. ?miliaris* IV(12)
- *C. pyriformis* IV(6)

Dentaliidae
- *Dentalium ?javanum* I(42, 94)

Doridae
- Doridae sp. V(9)

Enoploteuthidae
- *Abralia* sp. III(2, 14)
- *Enoploteuthis galaxius* III(1, 6, 26)
- *Enoploteuthis* sp. III(1)

Fasciolariidae
- *Fusinus colus* IV(5, 16) VI(–)
- *Fusinus* sp. O(1) II(15)

Ficidae
- *Ficus subintermedia* I(9, 86, 96) IV(6)

Fissurellidae
- *Scutus* sp. I(50, 97)

Glycymeridae
- *Melaxinaea labyrintha* I(49, 90, 101, 107) V(4)

Haminoeidae
- *Atys naucum* I(64)

Isognomontidae
- *Isognomon isognomon* I(97, 119)

Limopsidae
- *Circlimopa woodwardi* I(94)

Loliginidae
- *Loligo chinensis* III(11, 15, 22) VI(1, 2, 3, 5, 6, 7)
- *Loligo* sp. O(B, J) V(1, 2, 3, 5, 6, 11, 12)

Malleidae
- *Malleus albus* I(1, 2, 19, 85, 93, 94, 100, 101, 103, 104, 110, 113, 115, 119) II(14, 15, 17) IV(2) VI(4)
- *Valsella vulsella* I(121)

Muricidae
- *Bedeva paivae* I(121)
- *Chicoreus axicornus* I(61, 98) II(7)

C. cervicornis **I**(119)
Haustellum sp. **II**(7)
Murex nigrospinous **VI**(11)
M. tribulus **I**(2, 4, 7, 8, 9, 13, 29, 42, 50) **IV**(8) **V**(4, 6) **VI**(4)

Mytilidae
Modiolus ?elongatus **I**(96)
Musculus sp. **I**(5, 96)
Septifer bilocularis **I**(97)
Stavelia horrida **I**(97, 98)
Nassariidae
Nassarius dorsatus **IV**(12)
Naticidae
?Polinices melanostomus **I**(61)
Octopodidae
Eledone sp. **III**(4, 14, 15)
Haplochlaena lunulata **I**(62)
Octopus spp. **I**(86, 92, 97) **II**(10, 12) **III**(3, 7, 22, 23, 26,) **V**(5)

Ommastrephidae
Nototodarus gouldi **III**(3, 5, 6, 7, 19, 22, 23)
Todaropsis eblanae **III**(5, 15)
Ostreidae
Ostrea trapezina **I**(34, 44, 52, 55, 89, 93, 101, 113, 115, 121) **V**(12)

?Pycnodonte hyotis **II**(8)
Ovulidae
Volva volva **I**(11, 29, 64) **VI**(4)
Pectinidae
Amusium balloti **O**(A, B, C, D) **I**(2, 4, 6, 7, 8, 9, 10, 11, 13, 18, 19, 22, 25, 29, 34) **II**(4, 16) **IV**(12) **VI**(7)
A. pleuronectes **I**(5, 9, 10, 17, 18, 19, 22, 23, 30, 32, 37, 39, 40, 41, 42, 44, 45, 46, 47, 49, 50, 51, 52, 67, 68, 70, 71, 72, 74, 76, 77, 79, 80, 82, 84, 85, 86, 92, 94, 95, 96, 97, 101, 102, 104, 105, 106, 107, 111, 112, 117, 119, 120, 122, 123, 124) **V**(1, 5, 6, 8, 11, 12, 14) **VI**(2, 3, 4, 5, 6, 7)
Annachlamys leopardus **I**(86, 101, 119)
Chlamys gloriosa **V**(3)
C. ?gloriosa **I**(92, 93, 97, 98, 111)
Chlamys sp. **IV**(12)
Decatopecten ?strangei **I**(113)
Pectinidae spp. **I**(64) **II**(7, 8, 12, 14, 17) **III**(6, 26)

Philinidae
Philine sp. **I**(110)
Pleurobranchidae
?Euselenops sp. **V**(9)
Pleurobranchidae sp. **I**(8)
Pleurophyllidae
Pleurophyllidia sp. **I**(45)
Plicatulidae
Plicatula essingtonensis **I**(55, 89, 100, 101, 117)
Pteriidae
Pinctada panasesae **I**(115)
Pinctada sp. **I**(1, 93, 98)
Pteriidae spp. **I**(98) **IV**(1)
Sepiadariidae
Sepioloidea lineolata **III**(14) **V**(4)
?Sepioloidea lineolata **I**(7)
Sepiidae
Sepia cultrata **III**(2, 5, 14, 19, 23)
S. elliptica **I**(11, 22, 25, 36, 44, 45, 46, 53, 66, 69, 72, 79, 83, 85, 87, 88, 90, 102, 106, 119) **V**(5) **VI**(2, 3)
S. ?novaehollandiae **II**(8, 11, 13, 16)
S. papuensis **V**(9, 12)
S. ?papuensis **I**(58, 102) **IV**(1, 2)
S. pfefferi **I**(2, 5, 47, 103) **II**(13) **IV**(6, 12) **V**(13) **VI**(4)
S. pharaonis **V**(3, 12, 13, 14) **VI**(2, 3, 4)
S. ?pharaonis **V**(41, 47, 91, 102, 119) **VI**(1, 3)
S. plangon **I**(9, 47, 61) **V**(2, 9, 12)
S. rex **III**(3, 11, 14, 15, 18)
S. smithi **I**(7) **V**(12)
S. whitleyana (2, 7, 18, 19, 24, 30, 41, 53) **V**(13, 14) **VI**(3)
Sepia spp. **O**(B) **I**(46) **III**(1, 2, 5, 18)
Sepiolidae
Euprymna sp. **III**(14)
?Euprymna sp. **I**(24)
Rossia sp. **III**(6, 7, 23, 25)
Siliquariidae
Siliquaria sp. **I**(14, 26, 103) **IV**(6, 8)
Spondylidae
Spondylus ?barbatus **I**(115)
S. ?ducalis **I**(119)
S. tenellus **IV**(8)
S. cf. *tenellus* **VI**(4)
S. wrightianus **II**(10, 12) **IV**(1, 7) **V**(3, 4, 12) **VI**(5, 7)
S. ?wrightianus **I**(4, 6, 14, 34, 66, 96, 101)
Spondylus spp. **I**(34, 93, 101) **V**(3)
Spondylidae sp. **O**(I)
Strombidae
Strombus campbelli **I**(57)
S. dilatatus **I**(29, 41, 42, 43, 48, 51, 56, 59, 61, 63, 64, 85) **II**(11) **IV**(1, 6, 16)
S. erythrinus **O**(H)
S. vittatus **I**(8, 9, 11, 18, 19, 26, 34, 41, 43, 45, 64, 89, 113, 124) **IV**(1, 5, 6, 8, 16) **VI**(3, 4, 5, 6)

Trochidae
Angaria sp. **VI**(14)
?Clanculus sp. **I**(51, 110, 121)
Vasidae
Tudicula armigera **I**(3, 11) **IV**(12) **VI**(4)
Veneridae
Antigona lamellaris **I**(96, 103) **IV**(16) **VI**(4)
Callanaitis sp. **I**(94, 104, 107, 112)
Dosinia sp. **I**(28, 49, 67, 101) **V**(4, 8)
Volutidae
Cymbiola sophia **IV**(6)
Melo sp. **IV**(8)
Xenophoridae
Xenophora ?australis **I**(11, 29, 35, 42, 48, 94) **IV**(6, 8, 12, 16) **V**(9, 14)
X. cf. *australis* **II**(11, 15) **VI**(4, 3, 5, 7, 13)
X. helvocea **I**(2)
Xenophora spp. **O**(H) **II**(2, 7, 13, 15) **III**(25)

CRUSTACEA

Alpheidae
- *Alpheus* sp. — **IV**(6)
- *Synalpheus* sp. — **IV**(6) **V**(12)

Aristaeidae
- *Arlstaeomorpha foliacea* — **III**(2)

Calappidae
- *Calappa gallas* — **I**(118)
- *C. terraereginae* — **I**(4, 18, 49, 57, 64, 67, 77, 97, 104, 105, 106, 107, 120, 122, 123) **II**(11, 14) **V**(13) **VI**(4, 7)
- *Matuta inermis* — **II**(6)

Chirostylidae
- *Eumunida* sp. — **III**(8, 25)

Cirolanidae
- *Bathynomus* sp. — **III**(7, 8, 24)

Cymothoidae
- *Anilacra* sp. — **III**(6)

Diogenidae
- *Dardanus arrasor* — **III**(14, 15, 21)
- *Trizopagurus* cf. *strigimanus* — **III**(23)

Dorippidae
- *Darippe frascone* — **I**(58, 97) **II**(9, 10) **IV**(6) **VI**(5)

Dromiidae
- *Cryptodromia* sp. — **IV**(8)
- *Dramia intermedia* — **II**(8, 10, 11, 14)
- *Dramidiapsis edwardsi* — **I**(51, 59, 63, 92)

Eryonidae
- *Stereomastis phasphorus* — **III**(9, 26)

Galatheidae
- *Galathea elegans* — **IV**(2, 6)
- *Manida incerta* — **III**(6, 9)
- *M. japonica* — **III**(6, 7, 24)
- *M. squamosa* — **III**(7, 8, 9)

Glyphocrangonidae
- *Glyphacrangon* cf. *regalis* — **III**(6, 7, 25)

Goneplacidae
- *Carcinoplax* sp. — **III**(21)
- *Rhizopa gracilipes* — **I**(13, 16)

Hippolytidae
- *Hippalysmata* sp. — **V**(12)

Homolidae
- *Lutriellopsis petterdi* — **III**(1)

Leucosiidae
- *Arcania undecimspinosa* — **I**(49, 59, 79) **III**(21)
- *?Arcania* sp. — **I**(22)
- *Iphiculus* sp. — **I**(18)
- *Ixa inermis* — **I**(62, 115, 120)
- *Leucosia huswelli* — **IV**(6)
- *L. ocellata* — **I**(96, 103, 104, 112)
- *Myra ?affinis* — **I**(42, 107)

Majidae
- *Anacinetops stimpsoni* — **I**(113)
- *Chlorinoides aculeatas* — **I**(97, 118)
- *Chlorinoides* sp. — **IV**(8, 12)
- *Crytamaia ?maccallachi* — **III**(16, 25, 26)
- *Hyastenus diacanthas* — **I**(4, 9, 35, 46, 63, 111, 113) **IV**(1, 7)
- *Hyastenus* sp. — **II**(17)
- *Leptomithrax waitei* — **III**(2, 7)
- *Leptomithrax* sp. — **III**(3)
- *Micippa* sp. — **I**(57)
- *Naxioides taurus* — **VI**(7)
- *Paranaxia serpulifera* — **I**(55, 98, 113, 120)
- *Phulangipus australiensis* — **I**(9, 31, 45, 52, 58, 97) **II**(6, 8) **VI**(6)
- *P. ?hystrix* — **I**(7)
- *P. longipes* — **I**(28, 49, 120) **V**(9)
- *Picrocerus armatus* — **II**(9)
- *Platymaia wyvillethomsoni* — **III**(7, 25, 26)
- *P. fimbriata* — **III**(25, 26)
- *Tarinia* sp. — **I**(67)
- Majidae sp. — **IV**(4)

Pachylasmidae
- *Pachylasma* cf. *scutistriata* — **III**(25, 26)

Paguridae
- *Clibanurius* spp. — **I**(9, 10, 13, 18, 36, 41, 42, 43, 49, 51, 52, 63, 89, 97, 101) **IV**(1, 6, 7, 8, 9, 12, 14, 16) **VI**(5, 6, 7)
- *Pugurus ?imbricatus* — **I**(3)
- *Pylapagurus* sp. — **I**(19, 20)
- *Spiropagurus spiriger* — **I**(4, 19, 28, 35, 42)
- *Troglopagurus joasseuumii* — **I**(10, 22)

Palinuridae
- *Linuparus triganus* — **III**(2, 7, 23)
- *Paerulas* sp. — **III**(23)

Pandalidae
- *Heterocarpas sibagae* — **III**(1, 6, 7, 9, 25, 26)
- *H. woodmasoni* — **III**(6, 24)
- *Heterocarpus* sp. — **III**(7)
- *Purapandalus spinipes* — **III**(8, 15, 19, 22)
- *Parapandalus* sp. — **III**(21)
- *Plesioniku ensis* — **III**(6, 7)
- *P. ?longirostis* — **III**(2)
- *P. martia* — **III**(2, 6, 7, 8, 9, 19, 25, 26)

Parapaguridae
- *Parapagurus diogenes* — **III**(14)
- *P. pilosimanus* — **III**(25, 26)
- *Parapagurus* sp. — **III**(21)

Parthenopidae
- *Cryptapodia qaeenslandi* — **O**(B) **I**(93, 101, 104, 109, 119, 120, 122)
- *Parthenape contrarius* — **I**(29, 45, 51, 64, 105) **II**(1, 6, 7, 11)
- *P. curvispinus* — **I**(45, 100)
- *P. ?curvispinus* — **V**(2)
- *P. harpax* — **I**(61, 63, 67, 92, 113, 118) **IV**(1, 12)
- *P. longimanus* — **I**(1, 9, 41, 45, 49, 64, 98, 113)
- *P. langispinas* — **I**(45) **IV**(1)

Penaeidae
- *?Mucropetusma* sp. — **III**(22)
- *Metapenueapsis lamellutu* — **I**(7, 76)
- *M. ?rasea* — **I**(1, 7, 9, 10, 13, 16, 18, 19, 22, 28, 30, 31, 32, 35, 36, 38, 39, 42, 44, 45, 51, 56, 58, 65, 67, 71, 76, 94, 95, 97, 99, 102, 103, 104, 105, 106, 107, 113) **IV**(1, 9) **V**(9, 12, 14) **V**(6)
- *Metapenaeopsis* spp. — **I**(1, 7)
- *Metapenaeus endeavouri* — **I**(18, 37, 38, 39, 40, 69, 75, 76, 77, 78, 79, 80, 82, 83, 84, 85, 86, 100, 104, 106, 109, 110)
- *M. ensis* — **I**(100, 104) **V**(1, 5) **VI**(2)
- *Metapenaeus* sp. — **V**(10)
- *Penaeus escalentus* — **I**(36, 44, 48, 58, 69, 75, 76, 77, 78, 79, 80, 82, 83, 84, 85, 86, 93, 97, 104, 106, 108, 115, 120, 124) **V**(10) **VI**(3)
- *P. latisalcatas* — **I**(84)

P. longistylus **I**(3, 7, 35, 38, 41, 47, 50, 59, 95, 105, 106) **VI**(4)
P. plebejus **I**(3, 25, 28, 86) **III**(9, 11, 14, 15)
P. semisulcatus **O**(B, C) **I**(36, 37, 65, 66, 68, 73, 75, 77, 80, 85, 88, 91, 97, 100, 102, 103, 104, 105, 106, 108, 110, 120) **V**(6) **VI**(2, 3)
Sicyonia ?lancifer **I**(7, 63)
Trachypenaeopsis spp. **III**(7, 25, 26)
Trachypenaeus anchoralis **I**(68, 105, 106, 113)
T. curvirostris **I**(1, 7, 34)
T. granulosus **I**(7, 19, 22, 25, 28, 31, 34, 35, 39, 47, 68, 74, 89, 97, 105, 106, 107, 109, 120)

Poecilasmatidae
Poecilasmatidae sp. **III**(6)
Porcellanidae
Pachycheles sculptus **I**(92) **V**(12)
Porcellana furcillata **V**(–)
P. suluensis **V**(12)
Porcellanidae sp. **VI**(4)
Portunidae
Benthochascon hemingi **III**(6, 25, 26)
Charybdis bimaculata **III**(11, 22)
C. callianassa **I**(68, 71, 72, 87, 98, 104)
C. cruciata **VI**(2)
C. feriatus **I**(72, 83)
C. jaubertensis **I**(74, 79) **II**(5)
C. miles **III**(20)
C. truncata **I**(7, 18, 22, 30, 34, 68, 69, 70, 71, 72, 73, 74, 75, 81, 83, 84, 85, 86, 87, 88, 90, 96, 102, 104, 107, 112) **IV**(16) **V**(5, 6, 10, 11, 12, 14) **VI**(1, 2, 3, 6)
Lupocyclus philippinensis **I**(7, 9, 19, 34) **IV**(6)
L. rotundatus **I**(18, 79, 86, 97, 103, 118) **VI**(6)
Podophthalmus vigil **I**(72, 76, 85, 119) **V**(6, 10) **VI**(2, 3)
Portunus argentatus **O**(E) **I**(4, 5, 7, 8, 9, 10, 13, 18, 19, 21, 22, 23, 28, 29, 30, 31, 34, 38, 42, 45, 103) **IV**(6, 14) **V**(9, 13, 14)
P. gracilimanus **I**(47, 64, 69, 72, 76, 77, 80, 81, 85, 95, 97, 101, 102, 105, 106, 107, 111, 112, 120) **V**(5, 6, 10) **VI**(3)
P. hastatoides **V**(10)
P. orbitosinus **IV**(8, 14) **V**(12)
P. pelagicus **O**(K) **I**(22, 63, 71, 72, 80, 81, 83, 89, 91, 92, 95, 97, 104, 113, 115) **V**(10)
P. rubromarginatus **O**(E) **I**(58, 106, 119) **II**(8, 10, 11) **IV**(2) **V**(12) **VI**(4, 5)
P. sanguinolentus **V**(10, 11, 12)
P. tenuipes **O**(B, E, G, H) **I**(3, 9, 18, 19, 20, 22, 23, 28, 31, 32, 35, 36, 38, 39, 41, 42, 46, 51, 59, 63, 74, 95, 97, 98, 99, 107, 111, 120) **II**(5) **IV**(6, 14) **V**(3, 9, 11, 12, 13, 14) **VI**(1, 3, 4, 5, 6, 7)
Portunus spp. **I**(16, 18, 42, 45, 91) **IV**(14) **V**(14)
Thalamita sexlobata **IV**(12)
T. sima **I**(92, 113, 115) **V**(12)
Thalamita sp. **V**(1, 6)
Processidae
Nikoides sp. **I**(18)
Raninidae
Ranina ranina **II**(1)
Scalpellidae
?*Anandaleum* sp. **III**(6)
Arcoscalpellum pedunculatum **III**(6, 7, 8, 24, 25, 26)
Arcoscalpellum sp. **III**(6)
Scyllaridae
Ibacus alticrenatus **III**(1, 2, 8, 9, 10, 15, 18, 19, 23)
I. brucei **III**(2, 4, 5, 14, 15)
Ibacus sp. **III**(4)
Scyllarus ?rubens **IV**(6)
S. tuberculatus **I**(41, 61, 67, 76, 77, 80, 83, 84, 86, 93, 102, 104, 105, 106) **IV**(6) **V**(12)
Scyllarus spp. **I**(9, 18, 19, 28, 34, 39, 42) **VI**(7)
Thenus orientalis **O**(A, B, E) **I**(27, 36, 37, 40, 51, 57, 73, 78, 83, 91, 93, 94, 100, 102, 103, 104, 106, 110, 111, 119, 124) **II**(5, 6) **IV**(15) **V**(1, 2, 6, 11, 12) **VI**(2, 3, 5, 7)

Solenoceridae
Haliporoides sp. **III**(7, 8, 24, 25, 26)
Hymenopenaeus sibogae **III**(1)
Solenoceridae sp. **III**(6, 7)
Squillidae
Alima laevis **VI**(2)
Carinosquilla multicarinata **I**(7, 25, 47)
Chlorida ?depressa **I**(7)
C. granti **IV**(4, 6)
Gonodactylus falcatus **IV**(2) **V**(2)
G. graphurus **I**(52, 61, 67) **II**(6) **VI**(5)
Harpiosquilla raphidea **I**(83) **V**(5) **VI**(2)
Kempina cf. *mikado* **III**(2, 9, 11)
Lysiosquilla cf. *maculata* **VI**(7)
Odontodactylus cultrifer **VI**(5)
Oratosquilla ?gonypetes **I**(22)
O. woodmasoni **O**(B) **I**(7, 71, 72, 74, 76, 81, 82, 83, 85, 86, 87)
Squilla perpensa **VI**(10)
Stenopodidae
Stenopus hispidus **I**(31)
Stylodactylidae
Stylodactylus sp. **III**(24)
Xanthidae
Actaea savignyi **I**(104, 113, 121) **IV**(12)
Actaea sp. **IV**(1, 7, 12)
Actumnus pugilator **V**(12)
Liagore rubromaculata **I**(76, 87, 97)
Liomera ?venosa **V**(2)
Lophozozymus pictor **V**(2)
Parapilumnus? sp. **IV**(1)
Pilumnopeus sp. **V**(12)
Pilumnus semilanatus **I**(50, 55, 92, 97, 121) **IV**(8)
Pilumnus spp. **I**(4, 50, 63, 89, 92) **II**(1, 3, 6, 7, 8, 11) **IV**(5, 6, 8) **V**(12) **VI**(4)
Zalasius dromiaeformis **I**(97)
Xanthidae sp. **I**(92) **V**(2) **VI**(1)

ECHINODERMATA

Acanthasteridae
- *Acanthaster brevispinus* **II**(14)
- *A. planci* **IV**(2) **VI**(6)

Amphiuridae
- *Amphiura* sp. **III**(26)

Antedonidae
- ?*Euantedon tahitiensis* **I**(113, 118)
- *Toxometra paupera* **VI**(3)

Asteriidae
- *Pedicellaster* sp. **III**(–)

Asterinidae
- *Anseropoda rosacea* **IV**(4)
- *Nepanthia belcheri* **I**(2)
- *N. brevis* **VI**(7)
- *N. ?variablis* **V**(3)
- ?*Nepanthia* sp. **III**(26)
- ?*Parasterina* sp. **III**(25)

Asteroschematidae
- *Ophiocreas sibogae* **III**(20)

Astrometridae
- *Pterometra venusta* **I**(10, 16, 18, 36, 45, 52, 66, 90, 97, 100, 113, 118) **II**(15, 17) **VI**(5, 6, 7)

Astropectinidae
- *Astropecten monacanthus* **VI**(8)
- *A. ?phragmorus* **V**(9)
- *A. pulcherrimus* **I**(51, 107)
- *A.* cf. *schayeri* **III**(1, 26)
- *A. zebra* **O**(B, H) **I**(4, 6, 7, 8, 18, 26, 29, 31, 32, 35, 43, 44, 45, 46, 51, 52, 89, 94, 97, 101, 102, 107, 123) **II**(2, 14) **IV**(1, 6, 7, 12, 14) **V**(3, 4, 12) **VI**(4, 6, 7, 4)
- *A.* cf. *zebra* **II**(6)
- *Astropecten* sp. **III**(25, 26)
- *Psilaster acuminatus* **III**(1, 24)

Bathycrinidae
- *Metacrinus* cf. *nobilis* **III**(19)

Caudinidae
- ?*Acaudina* spp. **V**(1, 10)

Charitometridae
- Charitometridae sp. **III**(–)

Chiridotidae
- Chiridotidae sp. **III**(1)

Cidaridae
- *Eucidaris ?metularia* **V**(9)
- *Goniocidaris mikado* **III**(10)
- *Histocidaris australiae* **III**(25)
- *H. elegans* **III**(26)
- *Histocidaris* sp. **III**(25, 26)
- *Prionocidaris baculosa* **V**(9)
- *P. bispinosa* **I**(9, 11, 24, 70, 86, 89, 94, 101, 103, 109, 113, 118) **II**(7, 12, 14, 17) **IV**(1, 2, 4, 5, 6, 7) **V**(2, 12, 13) **VI**(5, 13)
- *Stereocidaris* cf. *microtuberculata* **III**(26)
- *Stylocidaris bracteata* **III**(14, 23, 25, 26)
- *S. conferta* **III**(5, 15, 19)
- *Stylocidaris* sp. **V**(2)

Clypeasteridae
- *Clypeaster* cf. *fervens* **III**(1)
- *C. reticulatus* **I**(2, 43) **V**(9)
- *C. telurus* **II**(3, 6, 11, 12, 13, 14)
- *Clypeaster* sp. **II**(6, 12)

Colobometridae
- *Colobometra bella* **O**(J)
- *Iconometra anisa* **V**(9)

Comasteridae
- *Capillaster multiradiatus* **VI**(7)
- *C. sentosus* **I**(120)
- *Comantheria* cf. *grandicalyx* **II**(11)
- *C. rotula* **O**(E, F) **II**(5, 7, 11, 13) **IV**(4, 7) **V**(2)
- *C.* cf. *rotula* **II**(5, 14)
- *Comantheria* sp. **I**(11, 56, 58, 60)
- *Comanthina belli* **I**(97, 118)
- *C. schlegeli* **II**(3, 7) **IV**(1)
- *Comanthus bennetti* **I**(14)
- *C. parvicirrus* **I**(22) **II**(3, 5, 11, 15)
- *C. samoanus* **V**(9)
- *Comaster* sp. **O**(E, I)
- *Comatella maculata* **I**(27)
- *C. nigra* **I**(56, 58, 60, 61, 63) **II**(7, 14, 17) **IV**(7) **VI**(5)
- *C. pectinata* **II**(4, 5, 7, 11, 12, 14, 15, 17) **V**(2) **VI**(6)
- *C. purpurea* **O**(E, F) **I**(14, 35, 51, 60, 85, 86, 94, 102) **II**(4, 5, 7, 11, 12, 13, 14, 17) **IV**(4, 5, 6) **V**(2, 9) **VI**(5, 7)
- *C.* cf. *purpurea* **II**(2, 7, 12, 13, 14, 17) **V**(3, 4, 9)
- *C. rotalaria* **O**(E, F) **I**(2, 4, 5, 7, 9, 10, 11, 13, 16, 18, 20, 22, 24, 25, 28, 29, 32, 34, 42, 44, 45, 46, 52, 54, 66, 90, 92, 94, 118) **IV**(2, 3, 16) **V**(12) **VI**(3, 4, 5, 6, 7)
- *C. solaris* **I**(2, 8, 9, 11, 16, 35, 42, 45, 52, 53, 60, 85, 118) **VI**(–)
- *C. stelligera* **II**(6, 11, 17) **VI**(5)
- *C. ?stelligera* **V**(9)
- *Comissia hartmeyeri* **II**(7)
- *Comissia* sp. **I**(5)

Cucumariidae
- *Orbithyone megapodia* **IV**(1, 7, 12) **VI**(4, 5)
- *Pentacta anceps* **I**(46, 56, 58, 61, 63, 92, 97, 101, 104, 105, 106, 107, 113, 117, 118) **IV**(7, 12) **VI**(5)
- *P.* cf. *anceps* **II**(2, 11)
- *P. australis* **V**(2)
- *P. crassa* **II**(2)
- *P. quadrangularis* **I**(63, 74, 103, 104, 105, 113)
- *Pentacta* sp. **IV**(1)
- *Pseudocolochirus axiologus* **I**(25, 104, 106) **IV**(1) **V**(5)
- *Pseudocholochirus* sp. **VI**(4, 5)
- *Stolus buccalis* **V**(2)
- *S.* cf. *buccalis* **VI**(5)
- *Thyone okeni* **I**(105)
- *Thyone* sp. **IV**(2)
- Cucumariidae sp. **II**(13)

Diadematidae
- *Astropyga radiata* **O**(E)
- *Chaetodiadema granulatum* **I**(2, 22, 26, 29, 46, 51, 69, 72, 83) **IV**(14) **V**(4, 13) **VI**(3, 5, 6, 7, 13)
- *Echinothrix calamaris* **II**(7)

Echinasteridae
- *Echinaster acanthodes* **I**(1)
- *E. luzonicus* **V**(4)
- *E.* cf. *purpureus* **II**(12, 13)
- ?*Echinaster* spp. **III**(10, 14)

Echinothuriidae
Araeosoma cf. *owstani* III(5, 14, 26)
Asthenosoma intermedium II(11)
A. varium II(5) V(3, 9, 12)
Hygrosoma cf. *hoplocantha* III(23)
Phormosoma cf. *rigidum* III(14, 25, 26)
Euryalidae
Euryale aspera I(46, 98) II(4, 5, 7, 11, 13, 14, 15, 17)
Goniasteridae
Anthenea crassa I(51, 61, 120)
A. ?crassa V(2, 12)
A. cf. *crassa* II(12, 13)
A. cf. *elegans* II(7)
A. mertoni O(F)
?Anthenea sp. II(15)
Goniodiscaster australiae I(83)
G. pleyadella I(9) IV(1, 12)
G. rugosus II(14, 15, 17)
Iconaster longimanus I(6) II(3, 6, 11, 12, 13, 14) IV(1, 2, 12) VI(5)
Mediaster australiensis III(25)
Mediaster spp. III(7, 24, 26)
Nymphaster moebi III(26)
N. pentagonus III(7, 26)
Nymphaster sp. III(24)
Pseudoganiadiscaster wardi II(2)
Stellaster equestris O(B) I(1, 2, 4, 9, 24, 33, 42, 43, 44, 45, 46, 50, 52, 56, 57, 58, 63, 71, 74, 81, 85, 86, 92, 97, 98, 101, 102, 119, 124) II(11) IV(2, 3, 7, 14) V(2, 13) VI(4, 5, 7)
S. cf. *incei* II(2, 6, 14, 15, 16)
S. cf. *inspinosus* III(8, 10, 25, 26)
Stellaster sp. III(20, 22)
Goniasteridae spp. III(3, 10)
Himerometridae
Amphimetra ensifera IV(2)
Heterometra cf. *crenulata* II(7, 11)
H. quinduplicava IV(2)
H. variipinna O(E, F, G, K) IV(1, 2, 3, 6)
Himerometra magnipinna V(9)
Holothuriidae
Actinapyga echinites I(56, 62) VI(4)
A. cf. *echinites* II(16)
A. cf. *miliaris* II(4, 11, 12)
Bahadschia cf. *argus* II(3)
B. cf. *marmorata* II(5, 15) IV(14)
Bohadschia sp. O(5)
?Bahadschia sp. V(9)
Halathuria edulis IV(1) VI(5)
H. cf. *leucospilota* II(12)
H. martensi I(49, 52, 56, 61, 64, 74, 81, 82, 83, 84, 101, 107, 109) IV(1, 3, 12)
H. ocellata I(7, 13, 24, 28, 36, 49, 84, 85, 91, 97, 107, 110, 113) IV(14) VI(4, 5, 7, 2, 3, 8)
Holothuria cf. *pervicax* I(2, 101) II(11, 12) VI(5)
Halathuria spp. II(13) III(15) V(3, 9)
Laganidae
Laganum depressum I(85) II(15) VI(14)
Peranella lesueuri O(D) I(2, 4, 9, 24, 46, 51, 56, 57, 62, 84, 90, 94, 113, 124) IV(1, 4, 14) V(3) VI(3, 4)
P. orbicularis IV(1, 6, 7, 8, 14, 16) V(4, 13) VI(4, 11)
Peronella ?orbicularis I(2, 28, 43, 46, 56, 57, 58, 63, 89)
Loveniidae
Lovenia doederleini V(9)
L. elongata V(9)
Luidiidae
Luidia hardwicki I(45, 52, 89, 99, 102, 119)
L. maculata I(9, 43, 57, 107, 122) II(8) IV(7) VI(5)
Mariametridae
Lamprometra klunzingeri V(9)
Liparametra articulata IV(1, 3)
Oxymetra erinaceus II(3)
Stephanametra indica V(9)
Mariametridae sp. III(8)
Metrodiridae
Metradira subulata I(9, 44, 51, 56, 61, 64, 83, 97, 98, 101, 103, 105, 111) IV(1, 4, 6, 8) VI(5)
Molpadiidae
Molpadiidae sp. III(23)
Ophiaetidae
Ophiodaphne materna II(12)
Ophidiasteridae
Certonardoa carinata I(2)
Leiaster glaber IV(12) V(9)
cf. *Linkia* sp. II(14)
Nardoa gomaphia IV(1)
Nardoa sp. IV(4) V(9)
Tamaria dubiosa II(6) IV(1)
T. fusca I(2) II(7, 13, 14) IV(1, 12) VI(5, 7)
T. megaloplax I(51, 118) IV(1, 12)
?Tamaria sp. III(11)
Ophiodermatidae
Cryptopelta granulifera IV(6)
Ophiarachnella gargonia IV(5, 6)
O. infernalis V(9)
O. similis I(27)
O. sphenisci I(74, 96, 97, 105, 110)
Ophiochasma stellatum I(10, 24, 46, 51, 85, 92, 94, 105, 118, 119) VI(4, 5)
Ophiapsammus yoldii I(101) IV(6)
Ophiotrichidae
Macrophiathrix kaelheri I(89, 97)
M. megapama IV(7)
Macrophiothrix sp. O(1) I(97)
?Ophiacnemis marmorata I(31)
?Ophiocnemis sp. III(21)
Ophiomaza cacaotica I(4, 8, 10, 11, 16, 17, 18, 25, 29, 32, 38, 44, 45, 49, 52, 72, 91, 94, 100, 118) II(4) IV(1, 2, 3, 6, 7, 12, 14, 16) V(12) VI(3, 4, 6, 7)
Ophiopteran elegans II(5) IV(5, 12)
Ophiathrix ciliaris I(89)
O. foveolata IV(1, 12)
O. melanastica O(F)
O. martensi O(J) I(64, 89, 92) II(15) IV(12, 16) V(2)
O. miles O(J)
O. nereidina O(1) IV(1)
O. ?nereidina I(102)
O. propinqua IV(4)
O. cf. *proteus* II(12)
O. purpurea I(45) VI(10)
O. cf. *scatiasa* II(12)
O. ?vigelandi I(94, 113)
Placaphiathrix melanosticata O(F)

Ophiotrichidae sp. IV(3)
Ophiuridae
Ophiomusium spp. III(24, 26)
Oreasteridae
Asterodiscus elegans II(1)
A. helonotus V(9)
Culcita schmideliana IV(1)
Pentaceraster gracilis O(C, D) IV(2, 3)
P. cf. *mammillatus* II(7, 11, 16)
P. regulus I(56, 60, 62, 63) II(2, 13) V(9) VI(4, 5)
P. tuberculatus IV(1)
?*Pentaster* sp. II(6)
Poraster superbus I(6, 46)
Paleopneustidae
Linopneustes cf. *fragilis* III(6, 7, 8, 19, 25, 26)
L. cf. *murrayi* III(7)
Phyllophoridae
Actinocucumis ?*typicus* I(56, 119, 120)
A. cf. *typicus* II(5)
Cladolabes sp. I(107)
Mensamaria intercedens I(101, 110)
Phyllophorus holothurioides O(F)
Phyllophorus sp. I(79, 101)
Phyllophoridae sp. I(94, 109)
Pterasteridae
Euretaster cribrosus IV(1, 2, 12)
E. cf. *cribrosus* II(2, 11)
E. insignis I(2, 9, 25, 51, 52, 61, 81, 83, 89, 92, 94, 105, 113) II(1, 2, 11, 12, 13, 14, 16) IV(1, 4, 12) VI(5, 12)
Schizasteridae
?*Protenaster rostratus* I(34, 66, 87, 90, 95)
Spatangidae
Maretia carinata II(14) VI(14)
M. planulata I(24, 35, 91, 100, 104, 105, 110, 111, 113, 117, 124) II(1, 3, 4, 15) V(4, 9)
Stichopodidae
Stichopus horrens I(4, 58, 60, 61, 64) II(1, 11, 13, 15) V(12, 13) VI(4, 6)
S. cf. *naso* VI(5)
S. variegatus V(12)
S. cf. *variegatus* IV(1, 14)
Thelenota anax V(9)
Synaptidae
Synaptula sp. VI(3)
Temnopleuridae
Salmaciella dussumieri I(11, 101, 104, 110) II(4) IV(1, 5, 7, 8) VI(4, 5)
Salmacis belli II(3, 11) IV(2, 7) V(9)
S. ?*belli* I(92, 103, 109)
S. ?*oligopora* I(2)
S. sphaeroides II(7, 11) V(12) VI(5)
S. ?*virgulata* I(113, 118)
Salmacis sp. I(61)
Temnopleurus alexandri V(9)
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Leiognathus sp. **O**(A, B, C) **V**(14)

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Lethrinella nematacantha **O**(B) **I**(14, 61, 112) **II**(13) **V**(12)

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Lophiodes cf. *mutilus* **III**(6, 7, 8, 9, 26)

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Brachaleuteres sp. **IV**(–) **V**(12)

Chaetoderma penicilligera **II**(14)

Paramonocanthus oblongus **I**(3, 41, 68, 89, 100, 104, 117, 120) **V**(12, 13)

Paramonocanthus sp. **I**(2, 6, 7, 28, 59, 67, 82, 83, 86, 89, 92, 94, 104, 117, 120, 122, 123, 124) **II**(1, 3, 11, 14, 15, 16) **V**(5, 8, 9, 10)

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Euclichthys polynemus **III**(19)

Physiculus cf. *nigrescens* **III**(8, 23)

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Upeneus filifer **IV**(–)

U. sulphureus **I**(40) **V**(1, 5, 6, 10) **VI**(1, 2)

U. sundiacus **I**(74, 76, 78, 80, 83, 85, 87, 92, 104) **V**(1, 6) **VI**(3)

U. tragula **I**(78, 92)

U. vittatus **O**(A, B, C, D, E)

Upeneus spp. **I**(46, 57, 61, 84, 89) **IV**(–) **VI**(4) **V**(9, 12, 13)

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Muraenesox bagio **III**(–)

M. cinereus **I**(80, 83) **V**(10)

Muraenidae

Lycodontis undulatus **I**(81, 92)

Myctophidae

Diaphus sp. **III**(6, 8)

Myrideae

Muraenichthys sp. **I**(72)

Nemipteridae

Nemipterus ?aurifilum **I**(104)

N. hexodon **VI**(3)

N. peronii **O**(B)

Nemipterus spp. **I**(7, 18, 19, 22, 36, 39, 40, 68, 69, 72, 73, 74, 75, 77, 78, 80, 83, 86, 87, 104, 105) **V**(1, 3, 4, 5, 6, 10, 12, 11, 13, 14) **VI**(1, 3)

Pentapodus paradiseus **I**(57, 89) **IV**(–)

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Halicmetus reticulatus **III**(25)

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Malthopsis sp. **III**(1, 22)

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Glyptophidium sp. **III**(6, 8)

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Lactoria cornuta **I**(83, 86)

Rhinesomus gibbosus **I**(3) **VI**(–)

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Elates thompsoni **I**(40, 72, 88, 90) **V**(6, 10) **VI**(2)

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Rogadius sp. **I**(7, 8, 9, 18, 19, 22, 29)

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S. tuberculatus **I**(7, 18, 25, 30, 32, 34, 39, 45, 61, 62, 112) **II**(16) **IV**(–) **V**(9, 12) **VI**(–)

Suggrundus sp. **O**(E) **I**(36) **III**(8, 11, 15, 19, 22, 23) **IV**(–) **V**(9, 12) **VI**(7)

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Lepidotrigla sp. **III**(3, 4, 6, 11, 14, 15, 23)
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